THE AEROPLANE

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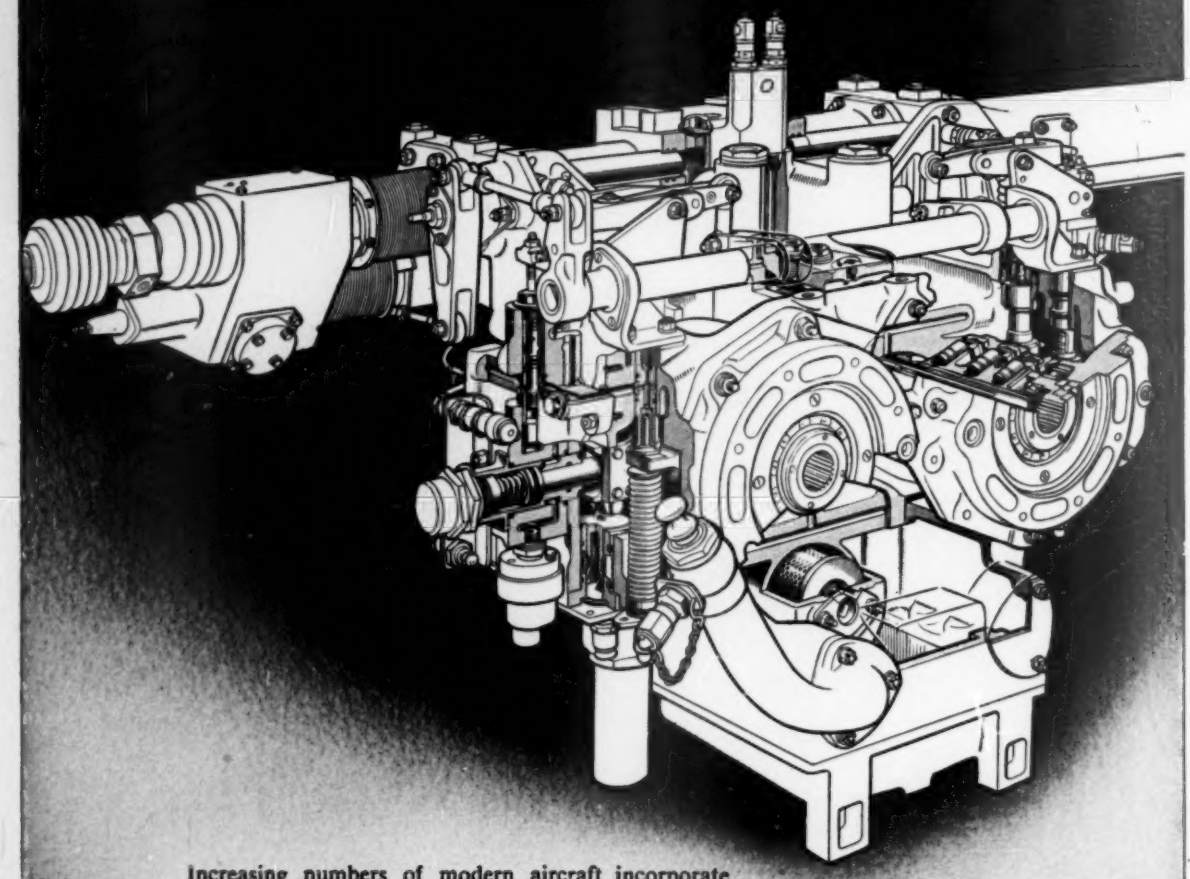

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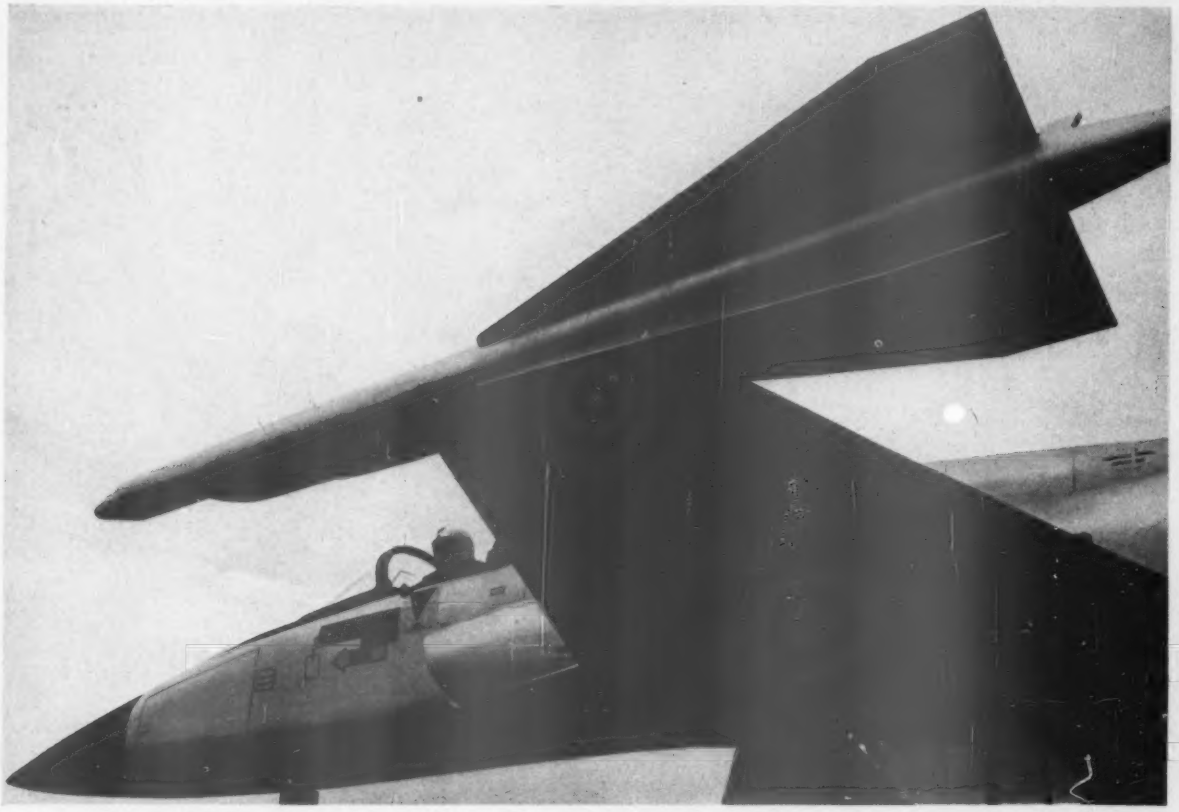

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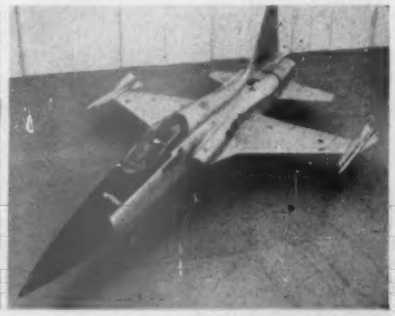

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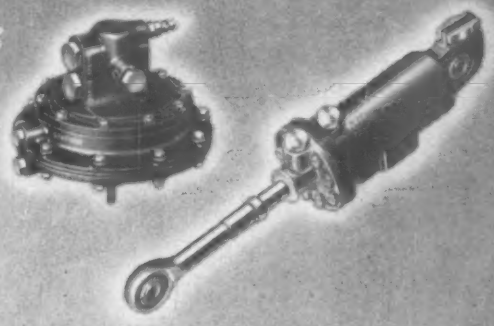

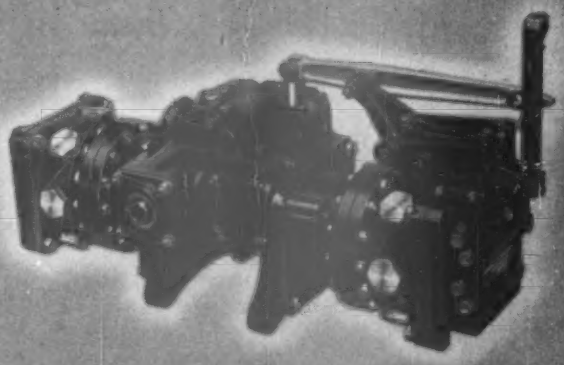

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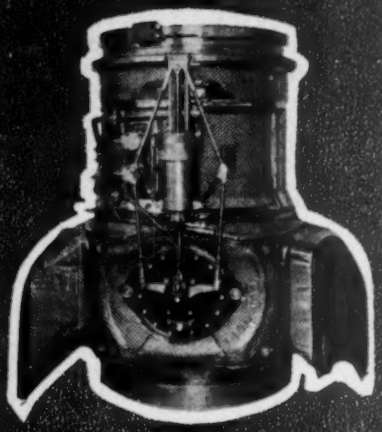

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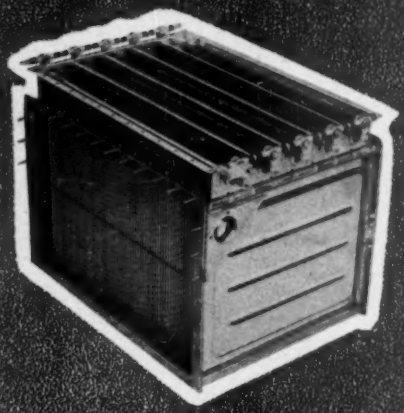

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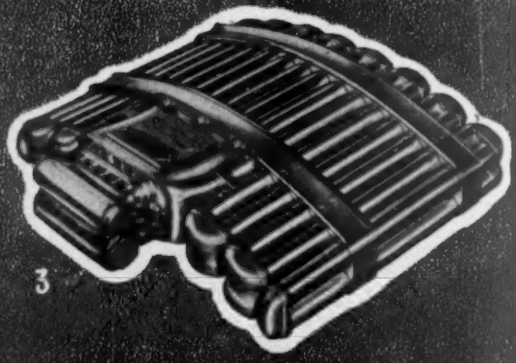

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THE AEROPLANE

Incorporating
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Edited by - - THURSTAN JAMES

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AIR EXPORTS AND THE FUTURE

IN this, the first issue of 1959, we take the opportunity to wish our readers at home and all over the World a happy and prosperous New Year. We are proud to point to the record export figures achieved during the first 11 months of the year that is past. What a wonderfully warming prospect we could all enjoy if our planners and politicians could be brought to see that the aeronautical exports of today are the outcome of wise decisions made as far back as 10 years previously.

In this connection it is perhaps worth getting on the record that it was as long ago as January, 1946, that the Vultee division of the Consolidated Aircraft Corporation, the forerunners of Convair of today, forwarded to the Army Air Forces their proposals for research and development on a workable ICBM. It is a vital part of the moral of this story that Vultee were able to do so because the U.S. authorities had put forward the requirement. In other words, the triumphant progress of the Atlas satellite around its orbit this Christmas is the direct outcome of work placed on the American aircraft industry 13 years ago; a period, incidentally, of special interest to the editor of THE AEROPLANE as he had just settled down to what was then a new job. No wonder then that if it has taken so vital a portion of his life to get an ICBM into orbit, he should be at such pains to impress on all and sundry the outstanding necessity of getting down to work on the British supersonic airliner.

Here is a project which those best qualified to know reckon will take our industry many years to get into the air. How essential then to wind up committee proceedings with the concomitant circulation and discussion of reports and recommendations, and instead to make a decisive and vigorous start on a supersonic design.

While in this country we are still pondering what to build as the next generation of airliner but one, in the United States further progress has been made in the business of getting out into space. President Eisenhower has appointed Dr. James Killian to be the head of the U.S. Federal Council for Science and Technology to co-ordinate the space programme. How many years is it, we wonder, since Sir Roy Fedden started asking for a body of wise men to take over the forward planning of Britain's aeronautical requirements?

Our Government has still not made up its mind about how the future of the aircraft industry is to be planned and all the while more far-sighted people are luring away the brilliant technicians whose talents are this country's greatest asset in the export field. It does seem extraordinary that when we have an industry that is consistently demonstrating its ability to earn really worthwhile exports not to take the firmest possible steps to ensure that it continues so to do.

It is not so many years ago that a well-known Conservative Member, now Sir Arthur Harvey, was telling an unconvinced House that the British aircraft industry would be selling £150 million of exports annually. Now that they are doing so, he had occasion in a recent debate not only to remind them of what he had forecast 10 years earlier but to warn them of the grim likelihood that in two or three years the figure may be down to £30 or £40 million unless something is done in the immediate future.

Mr. F. V. Corfield, the Conservative Member for Gloucester South, made the excellent point early in the same debate that it is virtually impossible to have a comprehensive debate on the aircraft industry while responsibility is spread around so many Departments of the Government. To the usual list of Ministries, which have so often been enumerated on our pages as having a finger in the aeronautical pie, Mr. Corfield added the Board of Trade as being responsible for export credits and the Chancellor of the Exchequer for finding the money. He hoped that the Government would seriously consider the setting up of a ministerial committee, or some such organization under the chairmanship of a single minister who would be responsible to the House. We hope the fact that no answer to this was forthcoming will not deter Mr. Corfield, and indeed all Members who are interested in the future of the aircraft industry, from pegging away at this point.

As things are, complication is inevitable and Mr. Corfield, himself dissatisfied with the failure of the Air Ministry to get requirements for Transport Command laid down early enough, suggested that the estimates for Transport Command should be taken away altogether from the Air Ministry and passed to the Ministry of Defence. There is no doubt at all that there has been a woeful blindness in high places to the facts of Commonwealth life and in particular to the needs of Commonwealth life-lines. Long-range high-speed large-load-carrying aircraft are a "must" in these days of disappearing bases. And oddly enough such aircraft would fit well into the World air traffic pattern.

Unfortunately, we cannot examine in extenso all the proposals put forward in that debate. Fortunately, it is not to be the last and so we can look forward to more vigorous onslaughts on a Government which seems strangely reluctant to ensure best possible use of the brains in its most productive industry.

Matters of Moment

Meaningless Assurances

IN February, 1955, when permission was given to B.O.A.C. by the Minister of Transport and Civil Aviation to place an order for 10 DC-7Cs it was clearly understood by both the Ministry and the Corporation that these aircraft would be sold for dollars just as soon as (to use the wording of the B.O.A.C. statement on March 10 of that year) "British-built aircraft can be brought economically into route service on the North Atlantic."

On December 18, 1958, in a written reply to a question from Sir Arthur Harvey, the Minister, after saying that this assurance had been given, explained that B.O.A.C. "will be able to employ the DC-7Cs as well as the Britannias until the extra capacity provided by the 15 Boeing 707s on order becomes available in 1959-60. The Government has therefore agreed that B.O.A.C. may retain the DC-7Cs until the Boeings are delivered, on condition that the DC-7Cs are then re-exported."

This does not make much sense. The Britannias are now, presumably, "economically in route service on the North Atlantic" and others (probably five) could be made available to the Corporation in a very few months if they were really wanted. The DC-7Cs will inevitably become more difficult sales prospects as the months roll by.

There may well be other good reasons why the DC-7Cs are being retained, but, to the onlooker, it would seem to be rational, as well as being good business for the British aircraft industry, to buy more Britannias and to sell as many of the DC-7Cs as can be spared in relation to the traffic likely to be offered on the North Atlantic during the coming 18 months. The onlooker would, too, consider that the Britannia is likely to be more attractive to traffic than the DC-7C during this period when there is strong and growing competition for the Boeing 707s and that the Britannias are likely to be more readily saleable during and after 1960 than the DC-7Cs.

MEN IN THE NEWS.—Top left, Sir Frank Spencer Spriggs, who has received £75,000 compensation after relinquishing his post as managing director of the Hawker Siddeley Group. At Vickers-Armstrongs (Aircraft), Mr. B. E. Stephenson (top right) becomes director of engineering; Mr. H. H. Gardner (bottom left) technical director; and Mr. G. F. H. Hemsley (bottom right) chief engineer (aircraft) and special director.

Hawker Siddeley VTOL Projects

CONFIRMATION that the Hawker design team at Kingston have been actively engaged on a VTOL aircraft project came last week from Sir Roy Dobson, the Hawker Siddeley Group's managing director. He is reported to have described the new aircraft as "a close-support fighter with vertical take-off capacity which will do all that the Hunter can do."

Sir Roy has, moreover, revealed that the chosen powerplant is a special Bristol engine. This is, of course, a logical development from the recently forged Bristol-Siddeley link which brought Bristol Aero-Engines into the Hawker Siddeley Group picture. It bears out, too, our forecast in THE AEROPLANE for December 12 concerning likely powerplants for future British VTOL projects.

No details of the new engine were forthcoming, but it had already been suggested that for the VTOL application the Bristol team favoured the use of a common powerplant for providing both forward and downward thrust. For such a purpose, emphasis would clearly be placed on low specific weight and a high available mass-flow to cater for the take-off case; some form of ducted-fan engine would appear to be required.

Some two years ago Dr. S. G. Hooker, discussing possible lines of future development, suggested to us that new engine forms might well be produced by making use of the components of existing engines. By these means, he argued, the overall development time for a new powerplant could be materially shortened. One might expect, then, that any special powerplant of the sort necessary for a new VTOL aeroplane would be derived by Bristols from some form of marriage between existing engines and using well-tried components.

There are, similarly, no details available concerning the new Hawker project itself—which has the designation P1127. A machine of the type briefly described by Sir Roy could be either a single- or a twin-engined aircraft, and it is likely that both these layouts have been studied. Nevertheless, one would suppose that for a close support aircraft with VTOL capability the single-powerplant layout would seem to be attractive and this would suggest that the P1127 is more likely to be a single-engine aircraft. There is nothing to suggest that its overall unorthodoxy would necessarily dictate a radical layout and one would not be surprised to find that its overall lines were reminiscent of its distinguished forebears.

The existence of another Hawker Siddeley VTOL aeroplane was mentioned by Sir Roy on the same occasion. There is, he said, an aircraft under development in Canada which has been described as a flying Jeep and is known as the Aerocar. This presumably was a reference to Avro Aircraft's Project Y, which has the U.S.A.F. weapons system designation WS-606A. This is a descendant of the company's remarkable all-wing VTOL project of 1951, which at the time was loosely referred to as a "flying saucer." That project was heavily shrouded by Security, but it was thought to derive its lifting and propulsive thrusts from a radical form of large-diameter short-length gas turbine engine mounted with its shaft vertical and rotating in the horizontal plane (see THE AEROPLANE for May 1, 1953).

It is believed that this particular form of powerplant is no longer in favour, although the general principle of a large shallow-depth ducted fan on a vertical shaft might well have been retained. Power for such a device could, of course, be provided by more orthodox turbojet engines (THE AEROPLANE for August 22, 1958). However, no details of this intriguing new project have been given. It is expected that the prototype will be ready to make its first flight fairly early next year and it will be interesting to see what form it takes.

Vickers Design Appointments

THE aircraft design activities of Vickers-Armstrongs (Aircraft), Ltd., are now being centred at Weybridge and as a result major changes will be made in the design organization of the company. A series of new appointments is being made, effective from January 1, 1959, and covering the whole of the company's aircraft design activities.

Mr. B. E. Stephenson, formerly chief engineer (civil aircraft)

is to become director of engineering. Mr. H. H. Gardner, who was chief engineer (military aircraft), is appointed technical director, and Mr. G. F. H. Hemsley, formerly assistant chief engineer (aircraft), becomes chief engineer (aircraft); Mr. Hemsley has also been appointed a special director of Vickers-Armstrongs (Aircraft), Ltd.

Directly responsible to the chief engineer (aircraft) are the following new appointments: Messrs. E. S. Allwright, E. E. Marshall and D. Parker, each of whom is appointed assistant chief engineer (aircraft), Mr. D. James as chief structural engineer, and Mr. E. J. Clark as design manager.

For the time being design work on the Scimitar will be handled by the design team at South Marston, under the direction of Mr. A. N. Clifton, who retains his present position as chief designer (Supermarine) until he takes up an appointment at Weybridge at a later date.

Operational Thors

FROM the Douglas Aircraft Company comes the news that the Thor IRBM has been accepted as operational by the U.S. Strategic Air Command. This announcement, which was made by Major-General David Wade of S.A.C., followed two successful Thor firings in one day—both of which resulted in the Thor missiles covering the full "programme range." One of the missiles was launched over the Pacific from the new range at Vandenberg Air Force Base, in California, and the other was fired over the Atlantic from Cape Canaveral, Florida. Both missiles are said to have landed within 5 miles of the intended impact point—which is considered to be an acceptable miss-distance with an atomic warhead.

Major-General Bernard A. Schriever, who is in charge of the U.S.A.F.'s ballistic missile programme, is reported to have said that the Thor's success was "the pay-off of three years of research, development and testing to achieve operational capability." One of the two firings was accomplished by an operational U.S.A.F. crew for the first time—they were trained by Douglas.

Thor has a design range of 1,500 nautical miles and, presumably, this was the range over which the missiles were fired from Vandenberg and Cape Canaveral. The powerplant of the missile comprises a North American Aviation, Rocketdyne division, liquid-oxygen/alcohol motor delivering a thrust of 150,000 lb. Weight of the complete weapon has been quoted as 110,000 lb.; it is 65 ft. long and 9 ft. in diameter.

An inertial guidance system developed by the AC Spark Plug division of General Motors is used. And control of the missile is effected by movement of the main rocket motor, which is gimballed, together with two vernier rockets for precision control.

Thor missiles are being supplied to the R.A.F. under the M.D.A.P. arrangements and the first base for these missiles has been set up at Feltwell, in Norfolk. Some photographs of one of these missiles on its launching platform at Feltwell were published in THE AEROPLANE for December 5.

Aircraft Exports Up

THE aircraft industry's total for the first 11 months of 1958 amounted to a record £142 million, some £26 million more than for the whole of 1957, which was itself a record year. This represents about £3 million a week, or an annual figure of about £155 million, and brings total aviation exports since the War to more than £775 million.

At £15,346,438, the November figure was boosted by record aero-engine sales of £5,188,087, amounting to nearly £700,000 more than in the previous record month (May, 1958). Aircraft and parts, at £9,601,045, also sold well, and the sale of electrical parts and appliances amounted to £284,783; tyres, £83,097, and aeronautical instruments, £189,426.

Brazil was our best customer, buying £1,591,569 worth of aircraft and parts, followed by South Africa, £1,343,641, India, £1,237,246, U.S.A., £1,016,589, and W. Germany, £980,010.

The January-November total — £142,176,592 — showed an increase of 43% over the equivalent period last year and a gain of 22% over the 12-month total. Aero-engines, at £45,687,618, exceeded last year's annual figure, which was a record, by some £5 million; the aircraft and parts total, £90,994,493, was £19 million above the previous record annual total in 1956; electrical parts and appliances sold to the extent of £3,073,989; tyres, £558,135, and aeronautical instruments, £1,862,357.

From Aviation to Steel

NEWS of an important appointment to one of Britain's most important industries came last week with the announcement by the Ministry of Power that Sir Cyril Musgrave, K.C.B., had been chosen to succeed Sir Archibald Forbes as chairman of the Iron and Steel Board. Having been closely associated with aeronautical affairs since 1937, first at the Air Ministry, later at M.A.P., and more recently at the Ministry of Supply, Sir Cyril is well known throughout the aircraft industry.

Born in June, 1900, he joined the Civil Service in 1919 and after a year with the Ecclesiastical Commission was, from 1920 to 1937, H.M. Inspector of Taxes. He transferred to the Air Ministry in 1937 as a Principal and in 1940 was appointed an Assistant Secretary at the, then, Ministry of Aircraft Production becoming Principal Assistant Secretary in 1943. In 1946 Sir Cyril was appointed Under-Secretary (Air) at the Ministry of Supply. He became Deputy Secretary in 1951, Second Permanent Secretary in 1953, and Permanent Secretary in 1956.

His many friends in all branches of the aircraft industry will wish him well in his new task to which he takes a wide knowledge of the problems of the industry.

NEWS ITEMS ARE ON PAGES 24-26.

COVENTRY CARRIER.—Sun shines on the first Armstrong Whitworth Argosy which was rolled-out at the week-end before Christmas. More photographs are on page 5.

Photograph copyright "The Aeroplane"

America's ICBM Satellite

ONLY 20 days after firing a Convair Atlas ICBM 6,300 miles over the Atlantic the U.S. launched a 4-ton Atlas vehicle containing special communication equipment into orbit at 11.02 hrs. G.M.T. on December 18. It took off from Cape Canaveral in an orbit of low inclination to the Equator, so it cannot be seen in the U.K., Europe or much of the U.S.S.R. The project was sponsored by the Advanced Research Projects Agency of the Department of Defence; its code name Score means Signal Communications Orbit Relay Experiment.

The object of the experiment is to transmit radio messages to the satellite where they are recorded on tape for later transmission when commanded to do so by ground signals. The U.S. Army Signal Corps is providing the ground radio service and so far the participation of stations in California, Arizona, Texas and Georgia has been announced.

In many respects this U.S. launching recalls the Soviet Sputniks of October, 1957. Strict secrecy was maintained for it had been widely believed that the 16th Atlas to be fired on December 18 was another full-range vehicle with an experimental silver-tipped nose cone.

Score's initial orbit was 114 miles at its perigee and 928 miles at its apogee. The corresponding eccentricity was 0.091; the maximum speed at perigee being about 26,700 ft. per second. The orbit is interesting because of the use of an ICBM vehicle and also because of the very low perigee.

Maximum speed of an Atlas on a 6,300-mile surface-to-surface ballistic trajectory is about 23,000 ft. per sec. at rocket cut-off. It then coasts upwards to a height exceeding 500 miles. The additional 3,700 ft. per sec. needed for Score is readily obtained by replacing the warhead and heavy re-entry nose cone with a special instrument compartment weighing only 150 lb.

Atlas should be capable of placing even heavier objects into a Score orbit or, alternatively, of reaching much higher orbits. On an ICBM trajectory the two outboard boost rockets and the central sustainer rocket fire from the start. The boost rockets and part of the flared skirt section are later jettisoned; the sustainer continues burning until it is closed down, the final velocity being achieved by very small vernier rockets.

Some time after this the warhead nose cone separates from the second propulsion stage. The second separation was not used in Score and the total weight in orbit has been quoted as between 8,500 lb. and 8,800 lb. depending on the fuel remaining.

The orbit of Score is compared with those of Explorer and Vanguard in Figure 1. The lifetime of a satellite in circular orbit at 114 miles would not be much more than an hour and Score will, therefore, encounter significant air resistance during its closest approaches to the Earth.

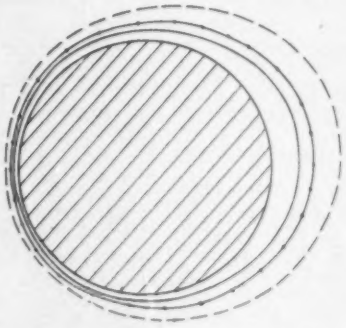


Fig. 1. Satellite orbits—full line, Project Score, apogee 928 miles, perigee 114 miles; dotted line, Explorer IV, apogee 1,373 miles, perigee 163 miles; broken line, Vanguard I, apogee 2,246 miles, perigee 406 miles.

This will progressively reduce the apogee, with little change in perigee, until the orbit is nearly circular, after which descent will be very rapid. This is expected in early February. Explorer and Vanguard are expected to remain in orbit for years.

U.S. official announcements emphasized the significance of the guidance accuracy. The guidance was presumably the normal Atlas radio-command system installed at Cape Canaveral but with different programming arrangements. This system employs a Doppler radar to determine missile velocity and acceleration and this is supplemented by a tracking radar for bearing and slant range.

Trajectory calculation is done on a large digital computer which compares actual with planned flight paths and transmits correcting signals to the missile. There is no basic reason why such a system should not give precise orbit control provided the missile can be held within range of the landing guidance system or passed to other down-range equipment.

From the operational aspect, however, a radio-command system suffers from the disadvantages of large ground facilities capable of handling only one missile at a time, susceptibility to enemy countermeasures, and difficulties of attenuation of the radio signals by the rocket exhaust gases. Guidance for the production Atlas will be by an Arma all-inertial system (as for Titan); this avoids most of the snags.

The Score satellite is equipped with radio receiver, transmitter, and tape recorder and battery power supplies. Frequencies of 132.435 and 132.905 megacycles per second are being used.

It is not yet known if the vehicle is rotating or has means of stabilizing itself or its aerials. Complete vehicle stabilization seems unlikely considering the technical difficulties and the weight in orbit. If the large cylindrical vehicle is tumbling, the difficulty of producing uniform signal strength will be far larger than has so far been solved in the small circular Vanguard satellite with its relatively long whip aerials.

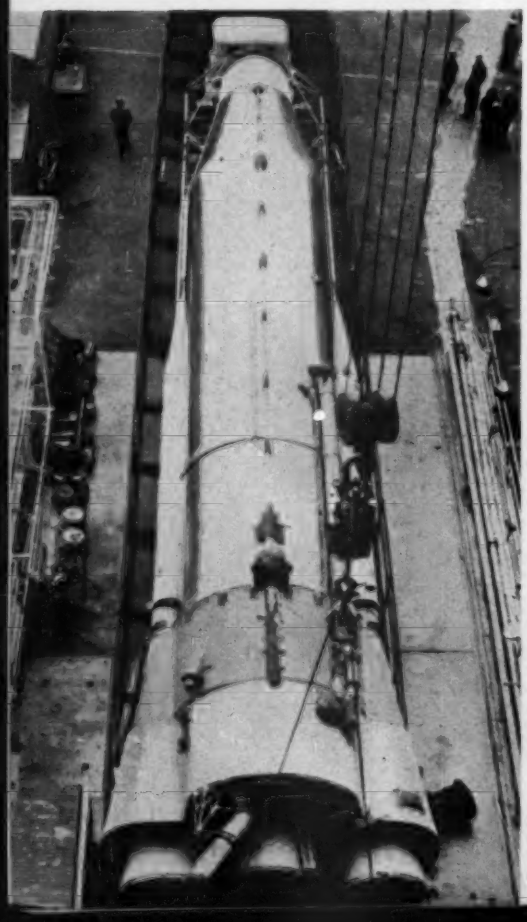
The experiments so far made have successfully demonstrated the principle of transmitting voice and multiple telegraph signals between Earth and a satellite—including a special Christmas message to the World from President Eisenhower. Some fading of this was detected although the general signal strength was good.

Project Score represents only a small beginning in opening up the technical field of communication satellites which has many interesting possibilities. By acting as a very high radio mast, such a satellite can extend considerably the coverage of VHF transmission whose two important advantages of freedom from interference and great availability of band width are seriously hampered by line of sight horizon range.

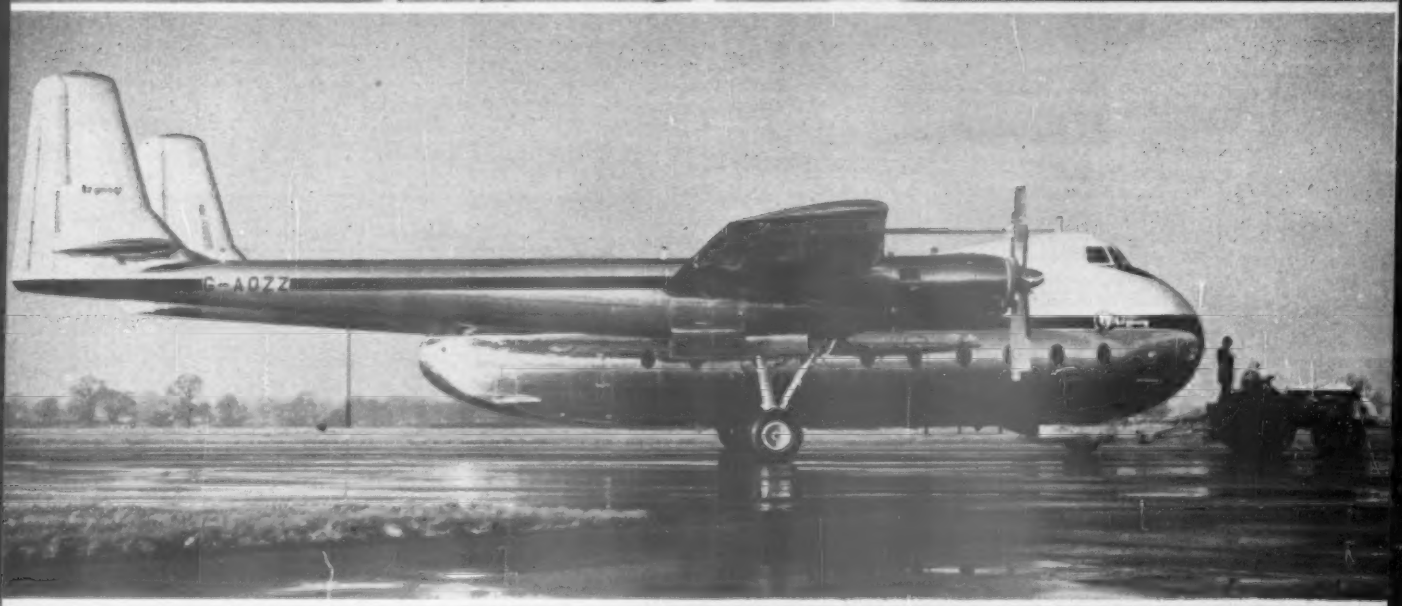
Frequencies which can be used in conjunction with satellites lie between about 100 and 10,000 megacycles per second. Ionospheric absorption precludes lower frequencies and atmospheric attenuation prevents use of high frequencies. The prospects of extending World-wide telephone, radio and TV communication into such a wide frequency spectrum is very attractive to the communication engineer.

Apart from propulsion and guidance problems the communication advantages change considerably with satellite height. At lower altitudes range is only partially World-wide and the satellite velocity introduces problems of tracking and Doppler shift allowance. These factors improve as the orbit height increases.

The 22,300-mile orbit is attractive, for World-wide coverage is possible with only four stations. The satellite might have either large mirror-type reflectors or powered repeater stations each needing close altitude control. The technical difficulties of establishing commercially useful stations at such a distance are, however, formidable and such sophisticated satellites may have to await more advanced propulsion systems and/or small-size low-weight communication techniques. The restricted range of the rapidly moving lower satellite can be to some extent overcome by placing several in a given orbit.—" BISONIUS."



Propulsion of Atlas is by two North American Rocketdyne LR93-NA-1 150,000-lb.-thrust gimballed booster rockets, a central Rocketdyne LR105-NA-1 60,000.-lb.thrust gimbal-mounted sustainer rocket and two small gimballed vernier rockets, also by Rocketdyne. All these rocket engines use RP-1 hydrocarbon fuel and liquid oxygen oxidant and are of the regeneratively cooled type. The two boosters are mounted on each side of the central sustainer engine and below the two guidance packs. Their gimbals are swivelled by hydraulic servos to control flight path and maintain stability of the missile.



Shortly before Christmas the first Armstrong Whitworth Argosy was moved from final assembly, at Bitteswell, to the flight hangar.

Photographs copyright "The Aeroplane"

SIGNALS— The Newest R.A.F. Command

SPEAKING at Medmenham on December 18 at a dinner to celebrate the formation of R.A.F., Signals Command, Marshal of the R.A.F. Sir Dermot Boyle, G.C.B., K.C.V.O., K.B.E., A.F.C., Chief of the Air Staff, said that the new Command now stood shoulder to shoulder with the Operational Commands as part of a team. In a modern air force reliance is placed to a very great extent on electronic aids in the accomplishing of missions. It was in recognition of this fact and because of the invaluable work which 90 Group had done over the past 10 years that the Air Council had decided to grant the group its new status. "Under this new title," he said, "we know that you will continue the sterling work for which you have become famous world wide."

Speaking in reply, the A.O.C.-in-C. of the new Command, Air Vice-Marshal L. Dalton-Morris, C.B., C.B.E., said that a separate Signals Command is unique in the Air Forces of the World. It is also unique, he explained, since it not only deals in technical matters but also has operational functions of great importance. The Command is able to fulfil an air staff requirement in the electronic field from the initial concept right through to acceptance trials whether it be air or ground equipment.

He took the opportunity of paying tribute to the very able and experienced civilian staff in the Command. Altogether they number some 2,500, the great majority of them of professional grade. At Command Headquarters around 150 professional and technical civilians were employed as radio engineers, designers and consultants. This body of technical experts, the Air Vice-Marshal pointed out, represents a sizeable proportion of the national assets in the technological field.

"We must make very sure," he said, "that we use them to the best advantage. For example, there are many tasks which I feel Signals Command is peculiarly well organized to handle more efficiently than industry and at considerably less cost to the taxpayer in the long run."

Particular mention was made of the presence of Air Vice-Marshal E. B. Addison and Air Vice-Marshal C. W. Nutting among the guests in view of their contribution to R.A.F. Signals achievement.

MR. C. I. ORR-EWING, Under-secretary of State for Air, spoke of the pleasure he and his fellow-guests experienced on being present at such an historic occasion. He admitted to feeling somewhat diffident about replying on their behalf as so many of them had been his bosses during his service with the R.A.F.

He spoke of the excellence of the dinner and then went on to speak about the skill of the band which they had the pleasure of listening to before dinner; it was composed entirely of volunteers from within the Command and this made its excellence all the more commendable.

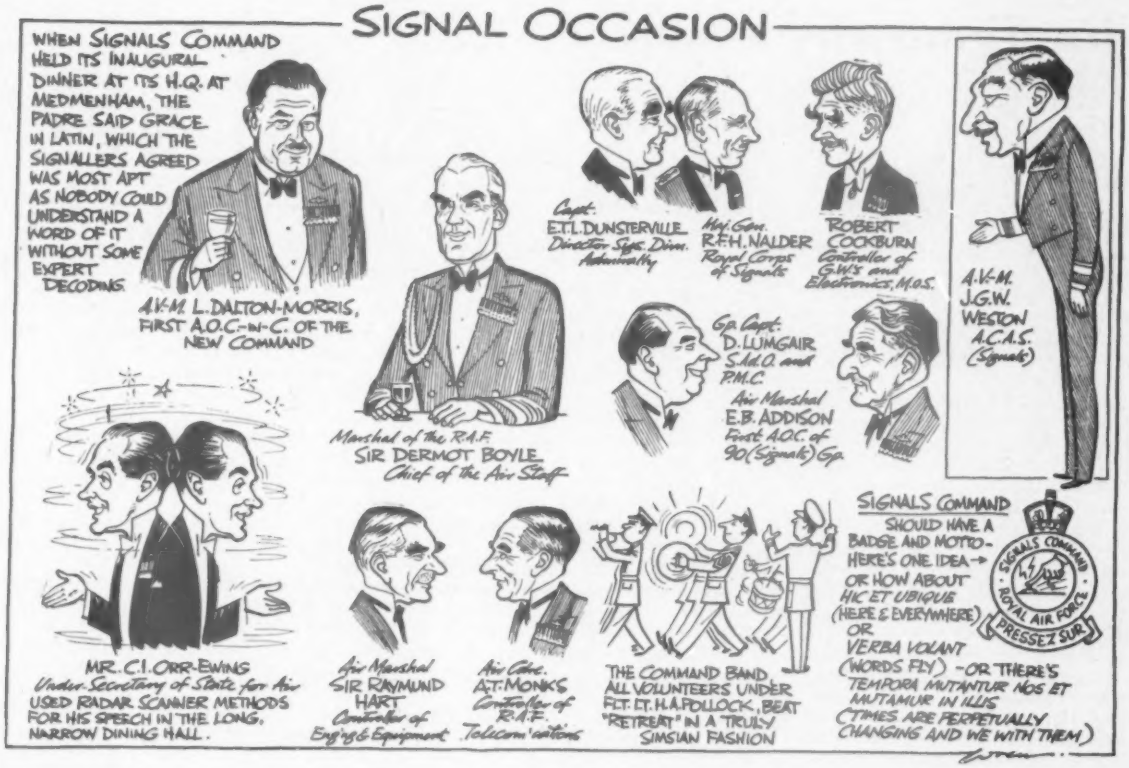
He recalled the earlier groups which had preceded 90 Group and made jocular reference to 60 Group which might be said

HOSTS AND GUESTS

Above left, Air Cdre. A. G. Powell (S.A.S.O., Signals), Capt. E. T. L. Dunsterville, R.N., Marshal of the R.A.F. Sir Dermot Boyle. Above right, Gp. Capt. D. Lumgair (P.M.C.), Air Marshal Sir Raymund Hart, Controller of Engineering and Equipment, Air Vice-Marshal J. G. W. Weston.

Above left, Gp. Capt. J. D. S. Huxley, Gp. Capt. D. W. Rowson and Air Marshal Sir Douglas Macfadyen (A.O.C.-in-C. Home Command). Above right, Air Cdres. J. C. Millar and H. G. Blair.

Left, at the top table, the Chief of the Air Staff, Marshal of the R.A.F. Sir Dermot Boyle, with the Commander-in-Chief, Signals Command, Air Vice-Marshal Dalton-Morris on his right. Extreme left, Mr. C. I. Orr-Ewing, Under-Secretary of State for Air and extreme right (back to camera) Capt. E. T. L. Dunsterville, R.N. Above, Air Vice-Marshal Dalton-Morris with Mr. Orr-Ewing and Air Marshal Sir Edmund Hudleston, Vice-chief of the Air Staff. Above right, Gp. Cpt. D. Lumgair and Air Vice-Marshal R. W. L. Glenn.


SIGNAL OCCASION
WHEN SIGNALS COMMAND HELD ITS INAUGURAL DINNER AT ITS H.Q. AT MEDMENHAM, THE PADRE SAID GRACE IN LATIN, WHICH THE SIGNALLERS AGREED WAS MOST APT AS NOBODY COULD UNDERSTAND A WORD OF IT WITHOUT SOME EXPERT DECODING
A.V-M. L. DALTON-MORRIS, FIRST A.O.C.-in-C. OF THE NEW COMMAND
Capt. E.T.L. DUNSTERVILLE Director Sigs. Div. Admiralty
Maj. Gen. R.F.H. NALDER Royal Corps of Signals
ROBERT COCKBURN Controller of G.W.'s and Electronics, M.O.S.
A.V-M. J.G.W. WESTON A.C.A.S. (Signals)
Gp. Capt. D. LUMGAIR S.M.O. and P.M.C.
Air Marshal E.B. ADDISON First A.O.C. of 90 (Signals) Gp.
Marshal of the R.A.F. SIR DERMOT BOYLE Chief of the Air Staff
MR. C.I. ORR-EWING Under-Secretary of State for Air USED RADAR SCANNER METHODS FOR HIS SPEECH IN THE LONG, NARROW DINING HALL.
Air Marshal SIR RAYMUND HART Controller of Engng & Equipment
Air Cdre. A.T. MONKS Controller of R.A.F. Telecommunications
THE COMMAND BAND ALL VOLUNTEERS UNDER FLT. LT. H.A. POLLOCK, BEAT "RETREAT" IN A "TRULY SIMSIAN FASHION
SIGNALS COMMAND SHOULD HAVE A BADGE AND MOTTO— HERE'S ONE IDEA → OR HOW ABOUT HIC ET UBIQUE (HERE & EVERYWHERE) OR VERBA VOLANT (WORDS FLY) - OR THERE'S TEMPORA MUTANTUR NOS ET MUTAMUR IN ILLIS (TIMES ARE PERPETUALLY CHANGING AND WE WITH THEM)
SIGNALS COMMAND ROYAL AIR FORCE PRESSEZ SUR

to have made the first successful take-over bid. He recalled, too, the work of 80 Wing and of 100 Group.

The former worked in close liaison with Fighter Command and aimed at spoiling the enemy's bombing aids. 100 Group sent its aircraft to accompany those of Bomber Command to deceive the radio and radar aids of the enemy's defences.

He had a much appreciated story about the small child who, being brought up in a township round a rocket centre, thought the proper way to count was downwards from ten, and worse than that, followed the zero with a horrifying expletive which apparently is what so often happens when a count-down at a rocket launch is followed by a non-start.

It is clear that Signals Command will have an increasing part to play in contributions to the fighting efficiency of the R.A.F. This will be particularly manifest in the realm of electronic warfare in which the new Command has a direct and vitally important responsibility. Equally important is the responsibility for the operation of radio navigation systems and for the design and operation of the R.A.F.'s world-wide telecommunications network.

As the C.A.S. had said at the beginning of his speech, the R.A.F. has come a very long way from speaking tubes, from rockets, flashing lights and "thumbs up" which formed the basis of the first communications systems. Last summer, while in the United States, the A.O.C.-in-C. of Bomber Command, Air Marshal Sir Henry Broadhurst, while at Pinecastle in the United States was able to ring up his headquarters at High Wycombe from a Vulcan parked on the ground.

It is remarkable how swiftly the telecommunications and signals side of the R.A.F. has grown. Up till 1939 the Commands looked after their own communications and were co-ordinated by the Air Ministry. Then in 1940 No. 26 (Signals) Group was formed to handle war-increased problems of global telegraph communications. At the same time No. 60 (Signals) Group was formed within Fighter Command to bring in the air defence radar stations. This group was also made responsible for GEE and OBOE, the principal navigation and precision bombing aids used by Bomber Command during the War.

When hostilities ceased, No. 90 (Signals) Group was formed under the Air Ministry to take over the functions of all these formations. Twelve years later on November 3, 90 Group became Signals Command. Today it may be said that the Command has three main divisions: radio engineering, electronic warfare; and telecommunications.

Taking the last-mentioned first, the Command is responsible through the Controller R.A.F. Telecommunications (CRAFT) for the working of the world-wide Commonwealth Air Forces telecommunications network. CRAFT also looks after the operation of the R.A.F. administrative telephone network.

As regards electronic warfare, the Central Signals Establishment provides the proving ground for the evaluation of techniques and equipment. Now that electronic aids are vital to the successful operation of manned and unmanned weapons, whether for offensive or defensive warfare, the study of techniques for spoiling the enemy's electronic systems and ensuring the uninterrupted use of our own is more important than ever.

Beating the Retreat.

To perform its manifold responsibilities Signals Command operates a number of aircraft, Canberras and Varsitys are used for radar and radio calibration, Comet 2s, Lincolns and Varsitys play their part in the development and proving of airborne equipment.

On the engineering side, Signals Command is engaged in the design, siting, development, prototype fitting, manufacture, installation and repair of ground radio and radar equipment of all kinds to meet global Service requirements. It is responsible, too, for the formation and functional control of overseas radio fitting parties. In the United Kingdom, the Command is responsible for the third line servicing of all radio and radar ground installations.

Its responsibilities will surely grow.

Air Transport

Enter the "Fan-jet"

WITHOUT any very loud trumpet fanfares, a little revolution in turbine-design thinking seems to have been happening. This, in time, may well lead to a revolution in our ideas about the prospective economy, flexibility and take-off performance of turbojet transports and to eventual peace between the turboprop and turbojet protagonists.

The "new" thing is the fan-turbine or "fan-jet." It is early yet to talk too freely in terms of dramatic major break-throughs and so on—but there does seem to be very much something in the newer trend in engine-design thinking. Rolls-Royce started this trend with the by-pass Conway—which is, so far, the only engine of the type in active existence—but General Electric (with the CJ-805-21 turbo-fan for the Convair 600), Pratt & Whitney (with the JT3D-1) and Bristol (who have, as yet, made no official statements about it) seem to be coming up with even more interesting designs or projects in this powerplant field. (The features of the JT3D-1 were initially described in THE AEROPLANE of May 30, p. 735, last year, and the CJ-805-21 for the Convair 600 was described and illustrated in the issue of October 3, pp. 517-519.)

Of course, there is nothing new about the principle of the use of a fan (or ducted propeller) to give higher mass flows and more efficient efflux velocities to the turbojet. Ten years ago, or more, many of us were convinced that the ducted-fan type of turbine would eventually replace all other powerplants. The idea was charming in its simple logic; unfortunately, the mechanics of the hardware were by no means so simple. In those days all turbojets were, to use a variant of the modern jargon, single-spool engines—in other words, with one compressor and one turbine on the same shaft—and an effective ducted fan involved some fairly troublesome reduction-gear problems and a not inconsiderable weight penalty. For one reason or another the ducted fan idea died; but the related by-pass idea remained alive—waiting for the kind of powerplant configuration and airframe requirements to make it worth while.

Now the interesting point is that the first American fan-turbine to be announced is, in fact, a development of a single-spool engine—the General Electric CJ-805. Very ingeniously, G.E. propose to get over the fundamental difficulties by hanging a free-running turbine stage at the back of the engine and, in effect, making the outer sections of the turbine blades act as a fan in an annular chamber around the jet-pipe. Disadvantages of the scheme are that it makes the engine fat where fatness is least wanted aerodynamically, and that the associated by-pass intake system may be difficult.

The other fan-turbine which has so far been described in some reasonable detail is the Pratt & Whitney JT3D-1. The JT3 engine is, like the Conway, of the two-spool type, so that the fan could conveniently be applied to the low-speed compressor. This engine has fan stages in front of, and on the same shaft as, the low-speed compressor and the flow is divided behind this fan—for which extra power is provided by an additional turbine stage.

These engines are still not so very much more than glints in the designers' eyes and the improved performance which is promised must be treated with some caution. Nevertheless, the figures are fairly exciting. The fan-jet Pratt & Whitney, for instance—a modification development of the JT3C-7—offers a 13% lower cruising specific, 33% more take-off thrust, 15% lower specific weight and reduced noise levels.

Such improved figures are not to be sniffed at; even if they are optimistic the effect at least resembles a break-through in turbojet performance. It is possible already to see a new generation of medium- and long-haul turbojet transports with lower gross weights in relation to payload, and with better take-off performances.—H.A.T.

Combination in Hong Kong

AIR services out of Hong Kong are to be rationalized as a result of an agreement concluded between Cathay Pacific Airways, Ltd. (C.P.A.), Hong Kong Airways, Ltd. (H.K.A.), and B.O.A.C. Associated Companies. A new company is to be formed by C.P.A. in conjunction with B.O.A.C. to take over the assets of C.P.A. and to buy the complete share capital of H.K.A. "with a view to operating a combined service throughout the two regional spheres at present operated separately by C.P.A. and H.K.A."

C.P.A. was formed in 1946 and in 1948 John Swire and Sons (with their associated shipping interests) and A.N.A. together acquired 80% of the shares. Other share holders included the P. & O. Shipping Company, The China Navigation Company and the Borneo Co., Ltd. B.O.A.C. have not had any interest in C.P.A., but have been joint owners of Hong Kong Airways with Jardine Matheson and Co., Ltd.

Services are flown by C.P.A. on routes to Singapore, Calcutta, Labuan, Bangkok, Saigon, Rangoon, Kuala Lumpur and Manila. The fleet comprises one DC-6B, one DC-6, one DC-4, and one DC-3, with two Electras for delivery in the first half of 1959. H.K.A. operates two Viscounts between Hong Kong and Manila, Seoul, Tokyo and Taipei.

Under the new arrangement, H.K.A. temporarily became a wholly owned B.O.A.C. subsidiary, and until the new company becomes fully operational in a few months' time, it has been placed under the management of C.P.A. under the aegis of one of the Swire companies. In return for relinquishing their holding in H.K.A., Jardine Matheson and Co., Ltd., will have a share in the new company. The board of the new company will consist of the existing C.P.A. board together with one director nominated by B.O.A.C. and Mr. Hugh Barton, the chairman of Jardine Matheson.

DEMONSTRATOR.—An Ilyushin Il-18 in Aeroflot colours was recently demonstrated to C.S.A. at Prague, where this picture was taken. C.S.A. are reported to have ordered some Il-18s for service this year.

It's proof like this that sells me the VISCOUNT

Capital Airlines figures emphasise original economy claims of the Viscount 700

These figures are taken from a study of operating costs recently made by Capital Airlines. The original estimates made in May, 1954, are compared with actual costs experienced in service.

Cost per aircraft-hour flown	*Original Estimate*	*Actual 6-months period ended 30th June, 1958*
DIRECT EXPENSE		
Pilots' salaries, travel; engine fuels; hull insurance; etc.	$ 96.15	$ 95.85
Direct maintenance labour, materials	57.76	47.12
Aircraft depreciation	45.91	46.36
Total direct expenses	199.82	189.33
INDIRECT EXPENSES		
Assigned expenses (of all other elements of operating expense allocated to types of aircraft on a formula basis)	$169.52	$169.20
Total operating expense	369.35	358.53
Costs per revenue aircraft-mile flown		
DIRECT EXPENSE		
Pilot's etc.	$ 0.402	$ 0.383
Direct maintenance	0.242	0.188
Aircraft depreciation	0.192	0.185
Total direct expense	0.836	0.756
INDIRECT EXPENSE		
Assigned expense	$ 0.709	$ 0.697
Total operating expense	1.545	1.453

It's experience—backed by figures like these—that is built into the Viscount 810/840

VICKERS VISCOUNT 810/840

FOUR ROLLS-ROYCE DART JET-PROP ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY ENGLAND

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Over 250 safe ejections have been made in Martin-Baker Ejection Seats. Of these over 40 are pilots and observers of the Royal Navy.

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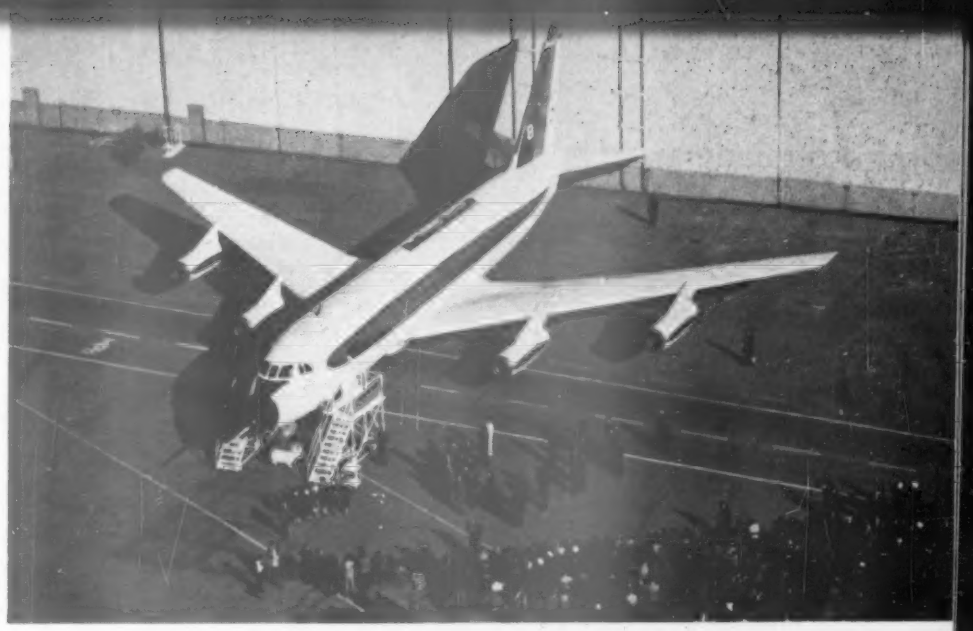
Convair Roll-out



SEVERAL hundred business and airline industry officials gathered at San Diego on December 15—at 8.30 a.m.—to witness the brief ceremony of rolling-out the first Convair 880 jet transport. After Mr. Earl Dallam Johnson, executive vice-president of General Dynamics, had described the 880 as "the World's fastest, most luxurious and most versatile jet aeroplane," Mr. J. V. Naish, Convair president, predicted that it would be in service "more than 20 years."

The doors of Building 3, containing the final assembly line, were then rolled back, and the Convair 880 emerged, its nose raised on a dolly to ensure hangar clearance for the top of the fin. The original idea of using an anodized gold-coloured skin overall has been abandoned and the first machine was glistening in a pristine white finish, trimmed with broad gold flashes down the fuselage and nacelle sides; the fin was striped in white, gold and black.

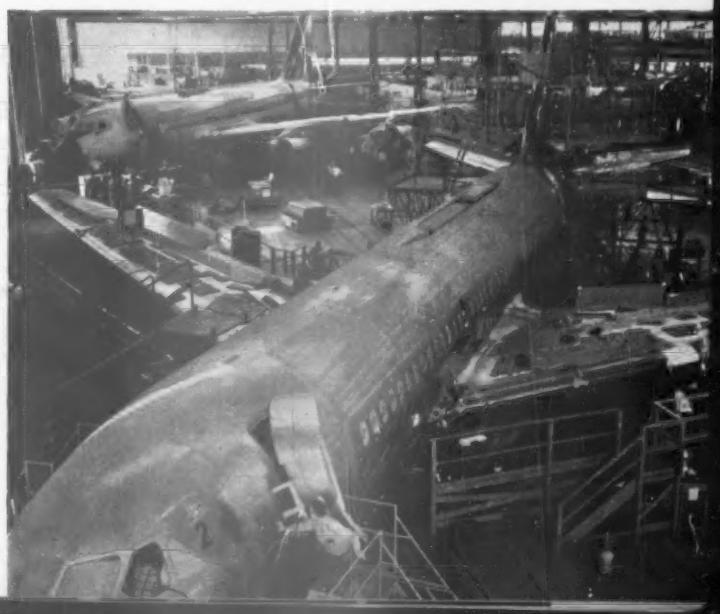
Flight trials with the first 880 are expected to begin on schedule at the end of January. Both this aircraft and the second example off the line—to be used for structural integrity tests—are in T.W.A. configuration (Convair Model 22-1) and will be delivered to T.W.A. among the last units of their fleet. The third aircraft, also for T.W.A., will fly in April, 1959 and the fourth, in Delta configuration (Convair Model 22-2), will fly in June. The C.A.A. certification programme, aimed at full certification by March, 1960, will be undertaken by the first three flying aircraft.

The first fully furnished 880 will be the fourth to fly, and while certification trials are in progress, both T.W.A. and Delta will receive some aircraft for route proving and crew familiarization. First delivery to T.W.A. is scheduled for November, 1959, with service to begin in the spring of 1960; Delta will receive their first 880 in January, 1960.

All these aircraft are the basic (or domestic) version, as ordered by T.W.A. (30), Delta (10), REAL-Aerovias (4) and Transcontinental (4). Capital Airlines are also completing negotiations for a fleet of these, with the help of General Dynamics' financing. The initial engine variant is the General Electric CJ-805-3, the thrust of which is now officially stated to be 11,200 lb.s.t. Noise suppressors and thrust reversers will be fitted as standard.

The Convair 880s ordered by Swissair (5 and an option on 6) are the intercontinental version, having centre-section fuel, a higher gross weight (204,000 lb. on the ramp compared with 185,000 lb.) and wing leading-edge slats to hold down the approach speed. Deliveries of this version are scheduled to begin in October, 1960. Both Swissair and SAS (who will lease two of the Convairs from Swissair) plan to fly these aircraft on their routes from Europe to South Africa, South America and the Far East via India.

In September, 1960, the first Convair 600 is expected to fly. This is the enlarged version of the design, ordered by American Airlines, who will take first delivery in June, 1961. This version will be powered by the General Electric CJ-805-21 turbo-fan engine rated in the 15,000 lb.s.t. class. Details of the Convair 600 and comparative figures for the 880, appeared in THE AEROPLANE for October 3, 1958; an eye-witness account of Convair 880 production was in the issue for August 1 and another view of the complete aircraft was published last week.



Two of the pilots responsible for testing the Convair 880—Don Germeraad, left, and John Knebel—are seen, above, in the cockpit of the mock-up. On the right is a view of the final assembly shop, with the second aircraft, in the foreground, being prepared for a nine-month structural test programme.

North Atlantic A.T.C. Problems

CONSIDERING the importance of, and the number of conflicting views about, North Atlantic traffic control problems and methods, the discussion after Mr. E. W. Pike's Royal Aeronautical Society lecture on December 18 was quite remarkably suave in tone. Most of those who took part in the discussion appeared to agree with the lecturer's views—summarized in THE AEROPLANE for December 19, pp. 885-886—but gave more information or stressed new points.

The urgency of the problem was interestingly highlighted by one of the off-the-cuff comments by Mr. Pike, who said that during an Atlantic crossing early in December the crew of a B.O.A.C. Comet 4 had sighted, at an estimated 4-5-mile distance, a small formation of B-47s flying at more or less the same altitude (35,000 ft.) diagonally across the track of the Comet—which flew through the contrails made by the B-47s. Later, one of two American contributors to the discussion, Col. J. Emerson, explained the situation over the U.S.A.F.'s system of altitude reservations.

Until comparatively recently, military traffic (which constitutes nearly half of that on the North Atlantic) had reserved for itself "blocks" of airspace including the equivalent of one hour's flying in front of and behind each series of movements. Now, thanks to better position reporting, the reserved airspace could be "rolled-up" behind the last aircraft in each group and the amount reserved was, in fact, no more than that demanded by individual civil aircraft. Block reservations were never made unless there were at least three aircraft involved and formations used only the airspace needed for one aircraft.

The discussion was opened by Capt. V. A. M. Hunt, Director of Control and Navigation, M.T.C.A., who showed two slides plotting the actual tracks of 70-odd eastbound and westbound aircraft during a night period over the east Atlantic. These slides gave a very dramatic impression of the amount and frequency of traffic. Capt. Hunt calculated that, had all these aircraft been fitted with the separation monitors recommended by the lecturer, cockpit alarm bells would have rung 150 times that night. He stressed the need for means of reliable lateral separation and said that Decca/Dectra was "very promising" as such a prospective means. The reservation of block levels could not be allowed much longer.

Although there was some disagreement about the importance of good communications, *per se*, as an aid to reliable A.T.C., the one practising airline pilot among the speakers, Capt. J. Woodman, said that the overall reason why Atlantic separations had to be so great was that communications were poor. He said that we can no longer tolerate a "see-and-be-seen" system in any context. Later, Dr. K. G. Bergin explained that high altitude operations introduced a new personal factor, "space myopia." Whereas, at lower levels, pilots' eyes, helped by distant clouds or horizon, focused naturally on infinity, it was found that at high altitudes the natural focal point was nearer and distant objects might not be noted.

Impressions during a most informative discussion might be said to have been partially summed up by the president, Sir Arnold Hall, when he asked, in his closing remarks, whether A.T.C. might not be running out of technical solutions to the problems posed by new developments. Nevertheless, though the new solutions may be more difficult, the onlooker left the lecture hall with the feeling that these solutions will, one by one, be found—but that there is very little time left. Such developments as reliable means whereby smaller lateral separations can be permitted, the introduction of airways, and the use of automatic data transmission and processing will all play their parts in the improvement which must come during the next two years or so.

About Jet Streams

IN a lecture to the Guild of Air Pilots and Air Navigators on November 25 Mr. E. Chambers, M.B.E., meteorological superintendent of B.O.A.C., discussed in some detail the latest knowledge on the subject of jet streams. Introducing his paper with a short historical survey, he pointed out that there is no strict definition of a jet stream, but to be worthy of the name it should have the form of a narrow tube containing winds exceeding 80 or 90 knots, with a central core of maximum speed, and should be located near the tropopause, which is the boundary between the stratosphere above and the troposphere below.

In practice, the central core is found just above a zone of strong horizontal temperature gradient (where colder and warmer air masses exist side by side), and the tropopause is some few thousand feet higher over the warm air mass than over the cold air mass. The temperature difference between these air masses is usually about 10° C., and, in general, the greater the temperature difference, the greater the wind speed.

Since warm and cold air are in juxtaposition along the polar front it is natural to expect jet streams to be associated with it. Where it has the character of a warm front, with the frontal surface sloping up forwards from its ground-level position, the jet stream is usually found 400 to 800 miles ahead of the surface front; similarly, a cold front slopes backwards and a jet stream is to be expected 200 to 400 miles in the rear of the surface position of the front.

The jet stream associated with the polar front is called by Mr. Chambers the "polar jet stream" to distinguish it from another jet stream commonly found nearer the Equator, called the "subtropical jet stream." This is not associated with any ground-level fronts, but nevertheless follows the line along which the tropopause undergoes a sudden change in level, just as it does at the polar front. In winter this subtropical jet stream may encircle the Earth without a break.

Position and behaviour of jet streams is much influenced by the underlying geography, and Mr. Chambers considered first the region of North America and the Western North Atlantic. Here the effect of the Rockies is to push the polar jet southwards to a mean position of about 40° N. in winter. Its core is at about 250 mb. (34,000 ft.), its speed often exceeds 200 knots, its direction is usually from between W.S.W. and W.N.W., and it often splits in two as it proceeds north-eastwards across the Atlantic.

Over Europe and the Eastern North Atlantic, jet streams can flow in any direction, but usually from between S.S.W. and N.N.W. The core varies in height between 25,000 and 40,000 ft., and the speed averages about 150 knots in winter and 130 knots in summer.

The subtropical jet stream crosses Northern Africa regularly in the winter and proceeds along the southern boundary of the Himalayas, though it shifts north of them during the S.W. monsoon. The core lies at about 40,000 ft. and its speed averages 100 knots, except when it joins up with the polar jet over N. Africa or the Eastern Mediterranean, when the speed may reach 200 knots.

At 40,000 ft. over Japan in winter, the westerlies, after being split by the Himalayas, reunite to produce the strongest mean winds in the World. Here the subtropical jet is correspondingly strong and its core speed averages about 160 knots, but this may increase to 250 or 300 knots if the Polar jet joins it, as frequently happens, and a speed of 373 knots was once recorded in 1953.

Over the North Pacific the jet stream distribution is similar to that over the North Atlantic. And in the Southern hemisphere there is less variation with longitude than in the Northern.

An easterly jet stream at 50,000 ft., rarely exceeding 100 knots, is found over Southern Asia during the S.W. monsoon, extending also over Africa. Another easterly stream is occasionally found over the Equator, especially over Singapore.

An important feature of jet streams, in addition to their speed, is the rate at which the speed diminishes outwards from the core, for the resultant wind shear can produce turbulence. There is also the possibility that a turbojet aeroplane, flying against a jet stream, could increase its ground speed by flying below the core at a lower altitude than its still-air optimum. However, a wind shear of at least 10 knots per 1,000 ft. would be needed to bring any advantage, and Mr. Chambers considers that the forecasting of such a condition would be too uncertain to justify the procedure, especially as it is likely to occur over only a short distance.

Another position of strong wind shear is found when a "trough" at upper levels has a strong northerly jet on one side and a southerly on the other.

Cloud observations can help to locate jet streams; high cloud, especially cirro-stratus or cirrus haze, often occupies the warm side and shows a sharp edge parallel to the jet axis, and long rolls or streaks of cirrus or cirro-cumulus can be seen in the warm air where a jet maintains its direction for hundreds of miles. If any high cloud occurs on the cold side, cirrus is more likely than cirro-stratus. Medium cloud and rain favour the warm side below the "entrance" of a jet, and the cold side below the "exit."

Mr. Chambers can see little prospect of better forecasts of jet streams and their associated clear-air turbulence. Over most of the World the network of upper air stations is totally inadequate. The reporting of upper winds to ground stations is hampered by pressure of other work in the cockpit and congestion of air-to-ground radio traffic, and he suggests that information from the measuring device in the aeroplane should be transmitted to ground stations automatically.—A.E.S.

Developments in Airport Lighting

by W. A. Villiers, B.Sc., A.C.G.I.

Photograph copyright "The Aeroplane"

A DC-3 on the approach to London Airport. In this article, the author, who is deputy general manager of the Lighting Division of the G.E.C. discusses some of the ways in which airport lighting is being improved.

LIGHTING on a modern civil airport is a complex, integrated pattern, representing the solution—or part-solution—of many separate problems. Aprons must be floodlit in such a way as to avoid dazzle to pilots while providing even and good illumination for aircraft maintenance and loading; roadways and car parks must be lit by special aero-screened lanterns which give no upward light, to avoid confusing the pilot on his approach; taxiways must be lit either by completely recessed lanterns that will stand up to being run over by aircraft, or by lightweight, frangible lanterns that will not cause damage in collision. But of all the problems to be tackled when an airport lighting scheme is prepared, the approach and runway lighting together form by far the most important elements.

The basic principle of the approach and runway lighting combination is to present the pilot with a lighting pattern that he can see easily and recognize immediately, and that will enable him to make a quick and accurate interpretation of the information which the lights are intended to give. He needs to know three things—the location of the runway, the correct path and "attitude" in which to approach the runway in order to make his touch-down within a preferred area, and the exact limits of the runway itself. These are what approach and runway lighting are designed to show.

Certainly the nature of radio aids, developed at a tremendous rate during and since the War, is now such as to enable an aircraft to approach the runway travelling in the right direction and at the right height for safety. The task of lighting is to take over from radio, even in bad visibility—*especially* in bad visibility—and enable the pilot to change over from instrument to visual flying on the final approach and landing. And I can foresee no revolutionary change in that requirement for a long time to come. Even with the possibility of vertical take-off and landing in the future, lighting will still be needed to indicate where the ground is, at night and in bad visibility, as it is needed now with helicopters which do not actually land vertically.

These statements, of course, bring me straight into conflict with radio engineers, who will claim that radio devices are even now sufficiently developed to cover not only a blind approach but a blind landing.* In reply to this there are two points to be made. First, radio aids including GCA are a very long way indeed from being effective unaided for the last critical 200 ft. of height before touch-down; radio beams cannot pin-point an aircraft's position—nor indeed can talk-down—but merely bring it down through a rectangle in the sky. Secondly, it will probably take a whole generation to adjust passengers psychologically to flying blind, let alone landing blind; it is, after all, vastly comforting to the passenger to come down out of the murk and see the runway lights flashing past the window just before touch-down.

So far as one can see, therefore, improved airport lighting, but still on the lines of the present pattern, will be necessary for anything up to 50 years to come. The key word, of course, is "improved." So far as the pattern is concerned the Calvert approach system of line and bar lighting, starting up to 3,000 ft. from the runway, providing the pilot with a "horizon" and leading him to the threshold where the runway lighting takes over, still seems the best known method. Figures for "approach success" (a first-time landing without overshoot) in reduced visibility for airports equipped with the ICAO line-and-bar system are, in fact, significantly better, at 93%, than for any other system. The supplementary approach aid of a centre-line of electronically operated flashing lights superimposed on the line-and-bar pattern, as used at some United States airports to "shoot" the way to the runway, is being studied in this country, but it is debatable whether it gives a useful aid or not. With their very short duration of flash and very high momentary intensity lasting only a few micro-seconds, these lights may be more off-putting than helpful to the pilot.

Accepting, then, that the pattern or method will remain the same, real improvement in airport lighting lies chiefly in solving the bad weather problem—the problem that has exercised the thoughts of lighting engineers constantly since the end of the War. This problem is mainly concerned with bad daylight visibility, since it is easier to see lights by night than by day. Its solution meets automatically the need for good lighting in good visibility, including good weather at night.

In short, the aim of current development in airport lighting is to keep every airport open under all conditions—to make bad weather diversions unnecessary, or at least seldom necessary, and thus to contribute greatly not only to the safety but to the economy of air travel. The latter is of great importance. To an increasing extent since the War, regular air services have become less dependent on the weather, and on this vital factor depends very largely whether air services pay or not. On present-day schedules, diversions for bad weather may add thousands of pounds to the cost of a flight. The problem will increase considerably with jet services, where a lower fuel margin will mean that the pilot must know well in advance whether he can land at his destination or whether he must divert.

In pursuit of this "ideal" of no bad weather diversions, one of the main tendencies in this country is to provide a bigger spread from the runway lights, to get well away from the high-power pencil beam sometimes used in the United States. These pencil beams are felt here to be much too narrow for comfort—that is, the pilot's comfort. Moreover they must be installed with micrometer accuracy, and could quite easily be put out of focus by ground vibration, particularly from jets. The view

Left, a high-intensity runway light, G.E.C. Type ZA105, and below, a three-colour angle-of-approach indicator.

* This article was written before the recent work of the Blind Landing Experimental Unit had been published. See THE AEROPLANE for October 17, 1958.

The high-intensity cross-bar approach lighting at Southend Airport.

in this country now is that a much broader beam, of about 25 degrees in azimuth, is needed. The object of this broad beam runway lighting is to give the pilot much more latitude than he has had in the past, bearing in mind the factor of instrument error in bad weather, so that if he is in the wrong approach attitude or direction he can see it much sooner than he could with the pencil beam—soon enough to make a correction. In other words, the new thinking on this aspect of airport lighting is to give the pilot's vision more scope, whereas the radio theorists, would seek to give it less.

Broader beams, of course, mean that higher wattages are needed; indeed the whole tendency towards higher intensity both in runway and approach lighting to give more light for bad weather means higher power all round. Already there has been a rise from 36 watts to 200 watts since the War, and wattages are bound to rise still further. This is not so unimportant as it sounds—in fact it is basic to the whole of airport lighting, for it presents the lighting engineer with very considerable physical problems to overcome.

There is the problem of temperature, for one thing. High wattages build up a colossal amount of heat which has got to be dispersed. In the past this would have been done by having larger lights. But caution is necessary here because operations people are seeking much lower ground propeller clearance for turboprops. (One American aircraft designer even quotes a clearance of 10.16 inches, though how such accuracy is arrived at when the loading is not known is difficult to understand!)

Moreover, lights which may be all right under normal rainy weather conditions may leak like sieves under the blast of water and dirt thrown up by a jet unless special precautions are taken. There are new glass problems to be solved, arising from the effect of the heat on refractors, and new problems on the lamps themselves, concerned with concentrated filaments of the right shape both for the light distribution and to fit an optical shape to withstand the heat from inside and the ground vibration from jets outside.

The temperature problem becomes even worse with coloured glass—indeed the whole question of aviation colours becomes difficult with high-intensity lighting. Very few glass works can produce satisfactory aviation colours to the very tight specifications required, and a slightly wrong colour changes appearance under certain weather conditions. Blue can look green, amber can look red, green can look white, and white can look green. The temperature problem may aggravate this by itself changing the colour of the glass. Another problem is condensation and misting up inside the light under high temperature.

All these individual points are now exercising the minds of lighting research people, all part of the general problem of providing more light for the pilot in bad weather to avoid diversion. One thing which such developments will answer is the present slightly confusing difference in appearance between approach and runway lighting. Up to now, runway and threshold lights have usually been of lower intensity than approach lights, so that at most airports the pilot passes approach lights of 80,000 candelas to be met by runway lights of only 8,000.

The tendency now is to bring the runway lights up to 25,000 candelas to match with the approach—the effect will be the same to the pilot because he gets closer to the runway lights—and to have a dimming system on both to vary the amount of light according to weather conditions. A new system of this kind has been installed at Southend, where the new runway lights are of 25,000 candelas with a broader beam—a system, incidentally, which greatly eases the task of radio control since pilots now only need to be brought to within two miles of the lights in normal visibility, where before they had to be controlled to within half a mile.

One other new aid, or rather a redevelopment of an old aid, arising out of the high intensity bad weather requirement is that of angle of approach indication, which has been largely ignored for some years past. Previously there were various types of low-intensity indicators, but they were not needed in good weather anyway so they fell out of use. Recently much work has been done on high-intensity indicators for use in bad weather, which is of course when they are needed. Two systems are under development: one a three-colour system using the same light source and showing the pilot red, amber or green, the other a two-colour system showing red, white or varying combinations of the two.

There, then, are the problems of airport lighting development in the immediate future—and, indeed for some time to come, because the high intensity question is not easily solved. Research work, both at Farnborough and in industry, is continuous with new problems coming up all the time. But I must make this point—all these problems are accentuated by the constant, tremendous problem of correct installation and maintenance of lighting systems. All the research effort that goes into this complex science can be completely negatived, and sometimes is, by faulty installation of the lights themselves.

High-intensity approach lights, carefully designed for direction and power of the beam, should not be mounted on poles that wave about in the wind. Runway lights should not be left dirty or broken. It is an incongruous situation that many airport authorities go to great trouble examining specifications and seeking the advice of the lighting engineer in order to buy the right equipment, and then neglect proper maintenance. If this problem were put right, then even out-of-date systems would be contributing far more effectively to the safety and economy of air transport, and the purpose of the developments that have been outlined in this article would be better fulfilled.

An impression of the high-intensity approach and runway lighting at Jan Smuts Airport, Johannesburg.

The Fighting Services

Integrated Air Defence

RECENT reports from Paris indicate that it has now been decided that Fighter Command is to be committed to NATO in the interests of an integrated air-defence system for Western Europe. All of the countries involved except France are reported to be in agreement with the plan.

West Germany, Denmark and Norway are in favour of integrated air defence, together with the Benelux countries, who have pointed out the need for an integrated early warning and control for a number of years. General Norstad has stated that without an integrated system there can be no defence at all.

As the United Kingdom would be involved in any NATO operations the decision to commit Fighter Command to SHAPE, on similar lines to the Canberra force already operating with 2nd T.A.F., would make little difference to its task. It has been stated that the Government has not been pressing for a R.A.F. officer to command the integrated air-defence organization, but the head of the air-defence staff at SHAPE has always been British. The present Director of Air Defence is Air Vice-Marshal H. D. McGregor.

The agreed plan would allow for the withdrawal of certain units in the event of overseas emergencies involving one of the NATO countries with commitments outside Europe

Mechanical Transport

THE 1958 competition for the Air Ministry Mechanical Transport Senior and Junior Efficiency Trophies has resulted in the Home Command station, R.A.F. Innsworth (Gp. Capt. S. E. D. Mills) winning the senior award with 2,804 points out of a possible 3,330, and Coastal Command's R.A.F. Mountbatten, Plymouth (Wg. Cdr. V. H. A. McBratney, A.F.C.), the junior trophy with 2,544 points. The mechanical transport officer at Innsworth is Flt. Lt. H. M. Sorrell, and at Mountbatten, W.O. S. Winks.

In the competition the senior class embraces stations with 35 or more vehicles and the junior those with less than 35 vehicles. Runner-up in the senior class was R.A.F. Ternhill (Flying Training Command) and in the junior section, Home Command's R.A.F. Tichfield.

Aircraft Recognition Contest

ORGANIZED by the Aircraft Recognition Society, the 12th annual All-England Aircraft Recognition Contest will be held on January 17, 1959, at the Royal Society of Arts, London. The contest is open to teams of three from the Services, the Royal Observer Corps, the Air Training Corps, the Combined Cadet Force and civilian clubs.

Photographs copyright "The Aeroplane"

SCIMITAR CONVERSION.—Part of the Fleet Air Arm Scimitar conversion course which is now in operation at the Naval Air Fighter and Strike School, R.N.A.S. Lossiemouth, includes a number of hours in this Air Trainer Link flight simulator. A pilot has to complete a number of exercises on emergency procedures and his "1st solo" in the simulator before taking off in the new strike fighter.

TREBLE ONE LEADER.—Sqn. Ldr. Peter Latham, right, has been appointed C.O. of No. 111 Sqn. at R.A.F. Wattisham, in succession to Sqn. Ldr. Roger Topp, A.F.C. Serving at the Air Ministry for the past two years Sqn. Ldr. Latham has over 2,000 hrs. to his credit. He flew No. 2 position in the No. 263 Sqn. Meteor aerobatic team at the 1950 R.A.F. Display and has served in Nos. 614 and 247 Sqns.

This year one of the awards, the B.E.A. Viscount Trophy for the top Service team, is being replaced by the Bristol Bloodhound Trophy presented by Mr. Peter Masefield, president of the Society. The other trophies consist of the Silver Hurricane as the top team award; the Bristol Britannia Trophy for the leading individual competitor; the Silver Hercules Trophy for the best cadet team; the "Air Pictorial" Silver Trophy for the runner-up to the team winning the Silver Hurricane, and the model of the Fokker D.21 awarded by the Chief of Staff of the Royal Netherlands Air Force to the highest-scoring individual in the Service teams.

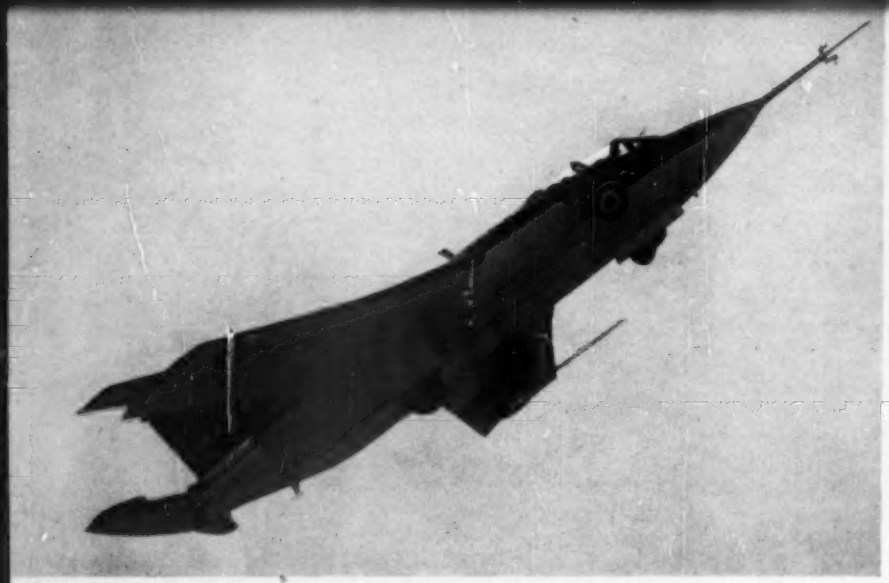
In the 1958 competition, the majority of the trophies were won by members of the R.Neth.A.F. team, with only the two cadet trophies—the Silver Hercules and the "Air Pictorial" award for the highest scoring cadet—going to teams from the United Kingdom.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Wing Commanders: C. H. Baker to command the R.A.F. Regiment (Malaya); N. J. Carver to R.A.F. Ballykelly, to command No. 210 Squadron; A. G. Clennett, M.B.E., to Headquarters, Maintenance Command, for technical staff duties; H. Drake to R.A.F. Kinloss, for technical duties; D. J. Griffiths to Air Ministry for duty in the Department of the Air Member for Supply and Organization; L. L. Harland, D.F.C., to R.A.F. Valley to command No. 1 Guided Weapons Trials Squadron; R. G. Knott, D.S.O., D.F.C., A.F.C., to Air Ministry for duty in the Department of the Chief of the Air Staff; T. McGreevy, O.B.E., to the Ministry of Supply; E. K. Paine to Air Ministry for duty in the Department of the Chief of the Air Staff; J. W. Sim, G.M., to Headquarters, Technical Training Command, for administrative staff duties; A. Vicary, M.B.E., to be Personal Staff Officer to the Inspector-General, R.A.F.

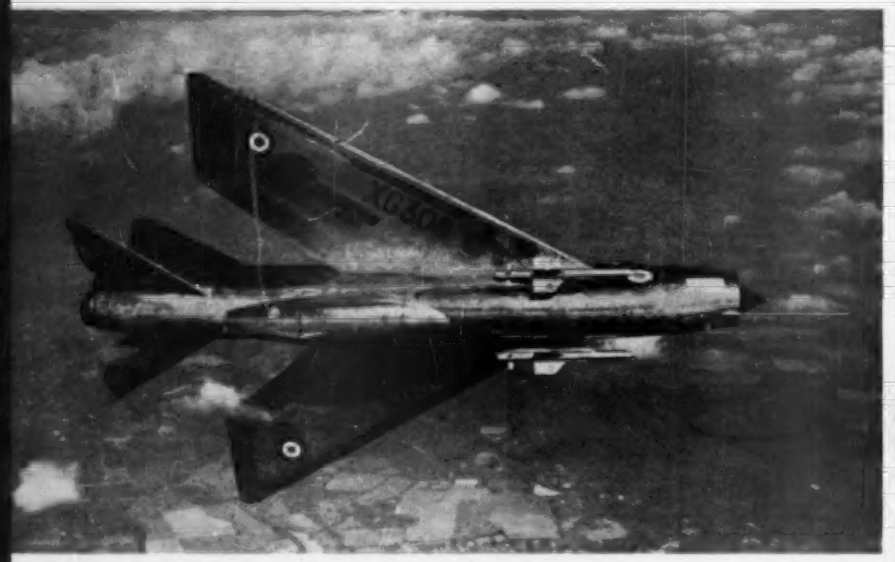
Squadron Leaders: G. J. South, D.S.O., D.F.C., to Air Ministry for duty in the Department of the Air Member for Supply and Organization (with acting rank of Wg. Cdr.); G. B. Weston to Cooke Air Force Base, United States Air Force, for liaison duties (with acting rank of Wg. Cdr.); R. Millhouse, M.B.E., to No. 5 (Light Anti-Aircraft) Wing, R.A.F. Regiment, to command (with acting rank of Wg. Cdr.); K. B. Rogers, D.F.C., A.F.C., to Headquarters, No. 1 (Bomber) Group, for operations duties (with acting rank of Wg. Cdr.).

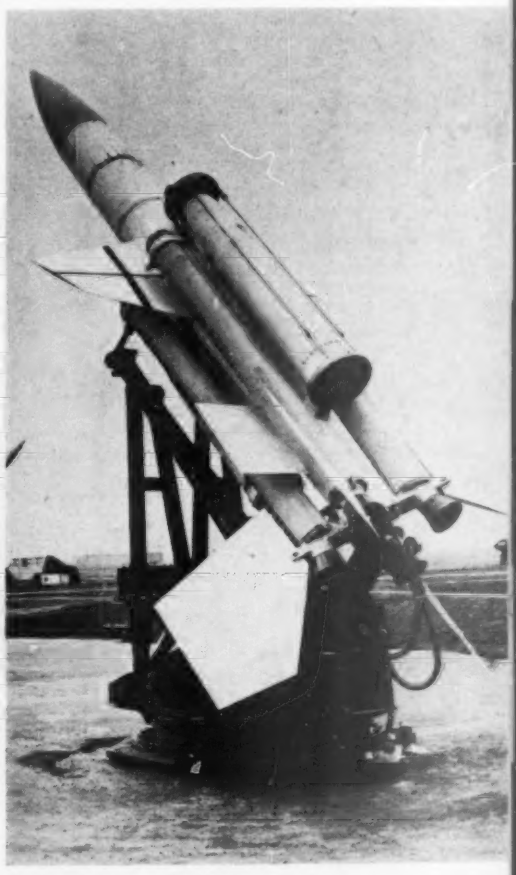


Firsts of

Above, a new strike aircraft for the Royal Navy, the Blackburn and General Aircraft NA.39 made its first flight in April.

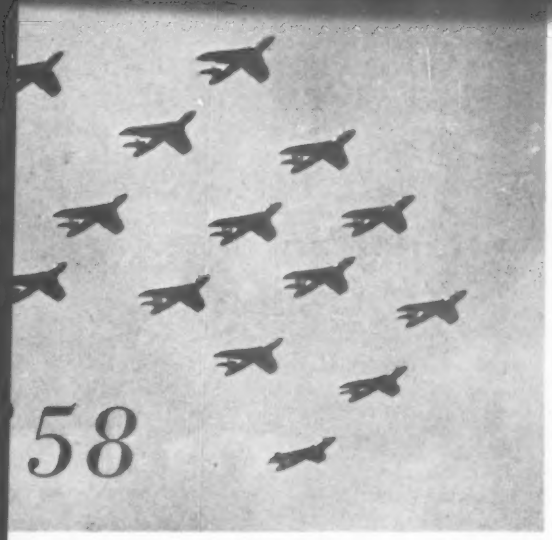
Below, an English Electric Lightning with two de Havilland Firestreaks was seen for the first time at the S.B.A.C. Display. During the year, Firestreak entered the early stages of operational service with the R.A.F. and the R.N.





Right, the Bristol-Ferranti Bloodhound surface-to-air guided weapons system went into service with the R.A.F. at North Coates during the year.

Below, on October 4, a de Havilland Comet 4 of British Overseas Airways Corporation inaugurated the first scheduled civil jet services over the Atlantic.

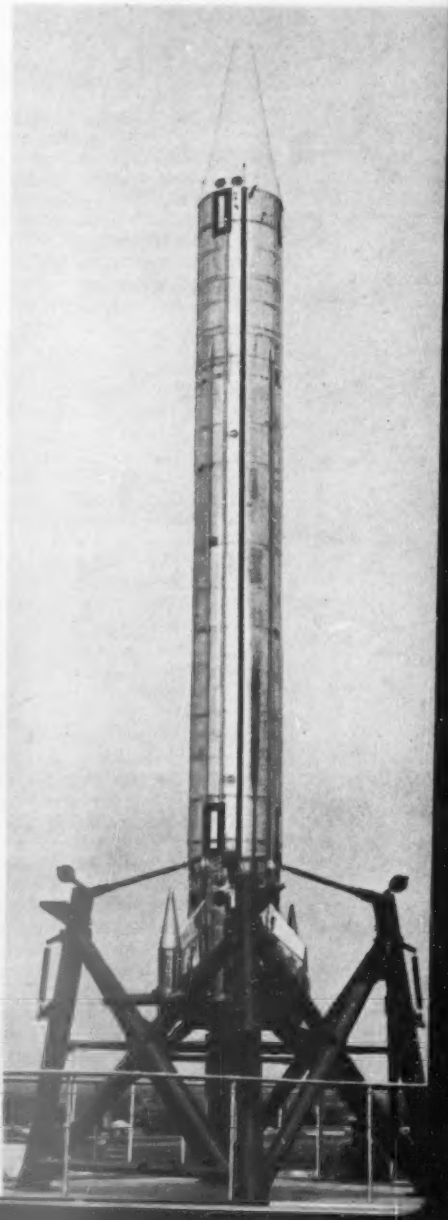


Above, a highlight—and a "first"—at the 1958 S.B.A.C. Display was the close formation aerobatics of 22 Hunters of No. 111 Squadron R.A.F.—seen here starting a loop.

Below, this D.H. Otter of the Trans-Antarctic Expedition made the first crossing of the Antarctic by a single-engined aircraft in January.

Above, Fairey's Rotodyne made its first full transition from helicopter flight to autorotational cruising flight on April 10.

Right, a large re-entry test vehicle, the first Saunders-Roe/R.A.E. Black Knight missile was successfully launched in September to a height of 300 miles from the Woomera guided-weapons proving range in Australia.



Right, the first Scimitar Squadron—No. 803, now on H.M.S. "Victorious"—was formed in June. Here are two Scimitars of No. 807 Squadron, the second to be formed.

Below, on June 9 Her Majesty the Queen performed the opening ceremony at the new Gatwick Airport, intended as the main alternate for London Airport.

Helicopter Vibration Investigations

by D. Howe, D.C.Ae., A.M.I.Mech.E., A.F.R.Ae.S.

THE nature of rotating-wing aircraft is such that vibration problems are always likely to occur in both design and operation. Many of these problems are identical in principle to those encountered in other branches of mechanical engineering, but are often much more severe because of the long shafts, numerous gearboxes and fluctuating loads which are invariably present. Other types of vibration encountered are peculiar to helicopters and like designs, and these require special methods of analysis. Both forms of problem have been investigated at the College of Aeronautics using model techniques.

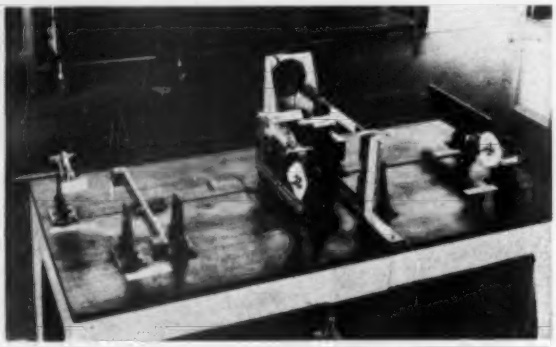


Fig. 1. Torsional vibration model of a helicopter transmission system.

One of the difficulties which may present itself in helicopter design is that associated with the torsional vibration of shafts.

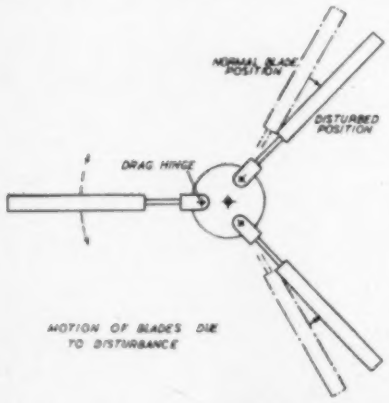


Fig. 2.

The torsional behaviour of the transmission system of a rotating-wing aircraft can be analysed readily by one of various mathematical techniques, and any tendency towards a dangerous condition can be isolated and rectified.

However, the nature of these mathematical approaches is such that any modification causing a change in the characteristics of the transmission system requires the whole process to be repeated. Examples of such a change are variation of driving shaft torsional stiffness, rotor mass or gear ratios. This need to repeat elaborate calculations may not be a serious disadvantage if the use of a digital computor is available; but, even so, some considerable time and cost may well be expended before an optimum set of conditions is derived.

An alternative approach is to use an analogue of the systems—either electrical or mechanical in form. The values of the important parameters can then be changed as desired and the effect upon system performance can be obtained immediately The electrical analogue system is quite simple and compact, but suffers from the usual drawbacks of such devices. On the other hand, the mechanical approach is more bulky, but also more reliable. An example of a model transmission system is shown in Fig. 1.

Electromagnetic exciters are used to impose torsional oscillations upon the model, this being more convenient than applying a perturbation to a rotating system. The modal shapes and nodes of the system at various frequencies provide the required design information. All the parameters are easily changed by varying shaft lengths or rotor inertias. No gearboxes are used, the frequency scale of the various branches of the system being adjusted appropriate to a uniform model frequency. Comparison with theory is very good for the modes of vibration so far investigated.

One of the most important of the problems peculiar to rotating-wing aircraft is that associated with instability of the aircraft whilst it is in a non-airborne condition. This ground instability, often loosely termed "ground resonance," is essentially mechanical in nature. The energy of vibration is derived from the rotation of the blades and the instability can arise in two ways.

In the first of these the rotational velocity of the blade system is such as to equal the vibrational frequency of the rotor pylon (or more generally the whole aircraft). This is analogous to the whirling of a rotating shaft at critical speed, and is hence often referred to as the "shaft critical" instability. The rotor r.p.m. at which this occurs is usually below the normal operating range and it does not present any serious difficulty in this case.

The second form of ground instability can be much more dangerous and troublesome. It is sometimes known as the "self-excited oscillation," and it closely resembles classical flutter.

On many helicopters the rotor blades are hinged at the root in both the horizontal (flapping) and vertical (drag) planes. This is done to reduce root bending moments to a manageable value. In the flapping plane there is considerable damping from aerodynamic forces, but in the drag plane this is not so.

Any small disturbance to the rotor system, as may be caused by a gust or uneven running of the engine, will tend to cause the individual blades to move about their drag hinges. As a result of imperfect mechanical and aerodynamic conditions, the

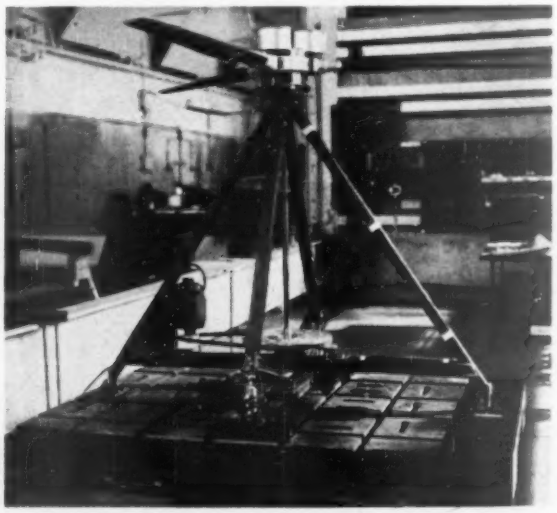


Fig. 3. An elementary model for ground instability research, having a single degree of freedom.

Fig. 4. A ground instability model with three degrees of freedom.

blades will also tend to move relative to one another. The effect is shown diagrammatically in Fig. 2.

It will immediately be appreciated that a rotating out-of-balance force at the pylon will result. Naturally, this will cause the helicopter to oscillate, and should the r.p.m. be such that one of the natural frequencies of the aircraft on its undercarriage is excited, the vibration amplitude will tend to become large. This overall vibration of the aircraft causes further out-of-phase movement of the blades about their drag hinges and the amplitude of the coupled oscillation rapidly increases—usually culminating in the almost immediate destruction of the aircraft.

Provision of dampers at the drag hinges reduces the tendency of the blades to move out of phase and, together with adequate damping in the undercarriage system, can be used to prevent the oscillation from building up to dangerous proportions. An alternative approach is to design the aircraft so that a self-excited oscillation does not occur in the rotor operating range. Although the instability as described is due to the provision of drag hinges, it can equally well occur due to blade flexibility

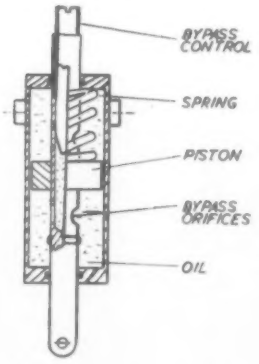


Fig. 5. Diagram of model shock-strut. The damping is viscous in form as it results from the passage of oil through the small clearance between the piston and the cylinder wall.

in the plane of rotation, even though discrete hinges are not used.

Theoretical analysis of the self-excited type of ground instability presents some difficulties, although with modern computing aids it is possible to predict the behaviour of an aircraft directly from the fundamental equations of motion. It is not so easy to assess the effect of variation of parameters because of the amount of computing involved, and the use of a model is attractive.

The main difficulties associated with the design of a dynamic model are connected with the choice of scales and the degree to which the model represents the full-scale prototype. As it is essential to reproduce a correctly operating drag hinge in the model, the length scale cannot be reduced below a definite value, which is usually of the order of 1/4 to 1/10. To some extent the mass scale follows by reason of the physical size and weight of the detail blade and rotor-head fittings, and is of the same order as the length scale. Only with regard to the choice of frequency scale has the model designer any real scope, and here two approaches are possible. On the one hand it is desirable to keep rotor r.p.m. as low as is possible to keep blade stresses, and driving-motor power low, and to minimize the chance of serious damage in the event of failure—which is by no means a remote possibility! On the other hand, the body freedoms of the model should be as representative as possible. And, unfortunately, the two requirements conflict.

A low frequency scale, say of the order of 0.5 full-size value, implies very low force and stiffness scales, and it becomes physically impossible to build springs representing the aircraft shock struts and tyres, which are strong enough to withstand the whole mass of the model. Thus, not only do inherent stiffness and damping become relatively important, but also it is necessary to provide bearings to support the model. These effectively constrain the modes of vibration to predetermined forms and if chosen badly will render the model useless.

The alternative is to use a high frequency scale of the order of 5, so that springs of adequate strength become possible, enabling the model to vibrate in realistic modes. Unfortunately, blade stresses become high and considerable power is required for the rotor, possibly necessitating a remote drive.

When the low-frequency approach is chosen it is necessary to decide upon the degrees of body freedom to be represented in the model. Experience has shown that the most important body freedom associated with the ground instability of conventional helicopters is that of roll. This is often combined with an overall lateral motion arising from sideways deflection of the tyres, and in some cases also with pitching. Yawing and fore-and-aft motion can also occur, particularly if the undercarriage system lacks high stiffness in the fore-and-aft direction.

Fig. 3 shows a model designed to use the low-frequency approach and having only one degree of body freedom, that of roll. It was used to develop the model technique and such components as drag hinge and shock-strut dampers.

A more elaborate model is illustrated in Fig. 4. This also uses the low-frequency approach, but has body freedoms in roll, pitch and lateral motion. The drag hinge dampers are located below the rotor head and consist of a number of pairs of steel and brass plates arranged to move relative to one another with blade displacement.

As originally designed it was visualized that these dampers would be operated in two different ways. Direct contact between the pairs of plates would provide simple friction damping, pressure being applied through a hard rubber block.

It was also hoped to obtain viscous damping, i.e., damping proportional to velocity, by separating the pairs of plates with rubber washers and filling the damper shell with heavy oil. Unfortunately, this last method did not prove to be successful as the frictional damping in the bearings was greater than the viscous effect obtained, the minimum spacing between the plates being limited by surface irregularities. There is provision on

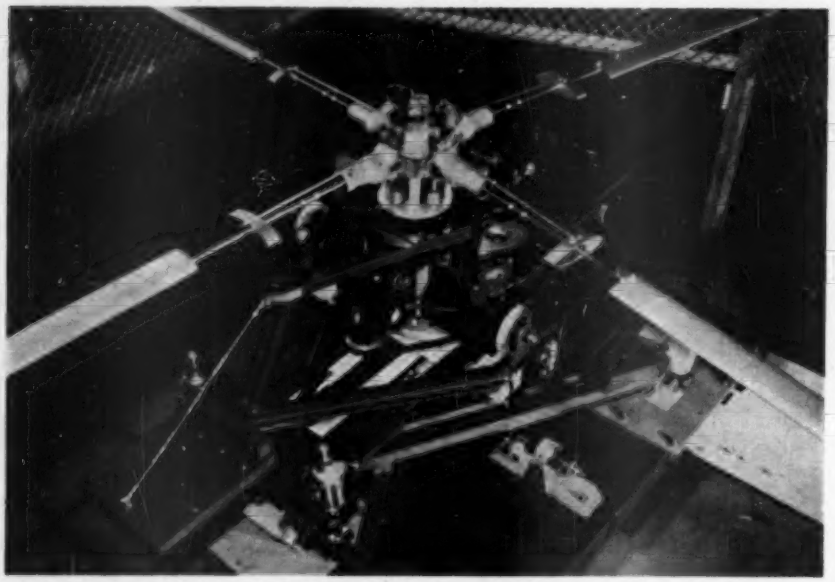


Fig. 6. Changed configuration in the model having three degrees of freedom.

the blade roots for the use of inter-blade springs and blade stops, and these have normally been fitted.

A diagram showing the design of the single nose and two main shock-strut units appears in Fig. 5. There are two main components, a single-acting coil spring to provide the required stiffness and an oil damper. The damping is essentially that resulting from the passage of oil through the small clearance between the piston and the cylinder wall.

Variation of damping is obtained by an adjustable by-pass incorporated in the piston rod, and this has proved to be very satisfactory. It does have the disadvantage, however, of introducing a certain degree of damping proportional to velocity squared, but this is minimized in a given series of tests by choosing a grade of oil such that the by-pass is used as little as possible.

Tyre stiffnesses in the vertical direction are represented by cantilever steel strips of adjustable length. A similar device is used to provide lateral stiffness, one spring functioning for both tyre and shock strut effects.

It is thought the tyre damping may play an important part in ground instability, but there is little information as to its magnitude. Some vertical tyre damping is incorporated in the model by using rubber inserts in the jaws forming the root fixings of the cantilever springs. An oil damping unit similar to the vertical leg units is used to represent total lateral damping.

The three-bladed rotor is driven by a DC motor through a pulley and belt system, speed control being provided. Rotor speed is measured by a voltage tachometer. The only other instrumentation consists of potentiometers mounted above and directly coupled to the blade hinge pins. A four-channel recorder is used to measure blade amplitude, frequency and relative phase from the potentiometer signals.

Although the model is not designed to be adjustable in every detail, considerable variation of parameters can be rapidly carried out. All spring and damper units are variable, mass distribution can be readily changed, and the use of standard items facilitates a change in configuration. An example of such a change is illustrated in Fig. 6, where the model is shown representing a helicopter having a four-bladed rotor and a quadricycle undercarriage. A new rotor head utilizing simplified drag hinge dampers having only one bearing surface is fitted, and the mass distribution has been changed, but otherwise the model is basically unaltered. This clearly demonstrates the versatility of the model approach.

During actual testing of the helicopter model it is necessary to introduce a disturbance to initiate oscillation. The number of oscillations required to damp out a disturbance of given amplitude is taken as a measure of the stability of the aircraft. This initial disturbance is normally obtained by shaking the model by means of a wire attached to it until the blade movement is the maximum permitted by the stops. It is, of course, quite possible to reproduce a divergent oscillation, but serious damage can result unless limiting stops are fitted to both blades and body units.

So far the models have been used to carry out a number of test programmes, aimed in two main directions. In some cases a direct comparison has been made with theoretical predictions and results from full-scale aircraft, and these have shown quite good agreement, although there is some evidence of a small degree of scale effect. This is as yet unexplained, but may be connected with the choice of body freedom axes, which has necessarily been based upon observations of the behaviour of past helicopters. It is hoped that this will be investigated in detail in the near future.

The other tests have been intended to investigate the influence of the various parameters on ground instability behaviour. The expected tendencies due to variation of damping, mass and stiffness have been found, but of more interest are the effects of coupling in the various modes of vibration and the relative importance of the individual parameters. For example, Fig. 7 shows the effect of increased damping in the lateral mode upon the instability characteristics of the quadricycle model, under constant-r.p.m. conditions.

The stability of the model decreases with increasing damping, due to the tendency to uncouple the modes. Increase of lateral stiffness has the same effect. Change of undercarriage track has been reproduced on this model and found to be of little significance.

Experience so far gained with the use of the model technique has shown conclusively the possibilities of this approach to the solution of vibration problems. It would seem to be especially useful in the early stages of design, as an early check on the aircraft's characteristics, to be backed up later by full-scale and theoretical work.

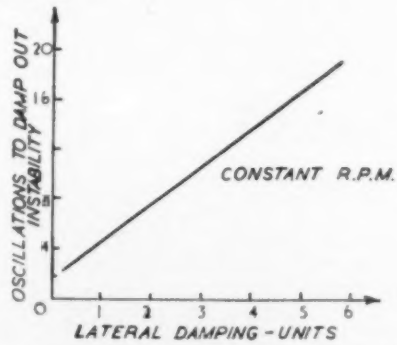
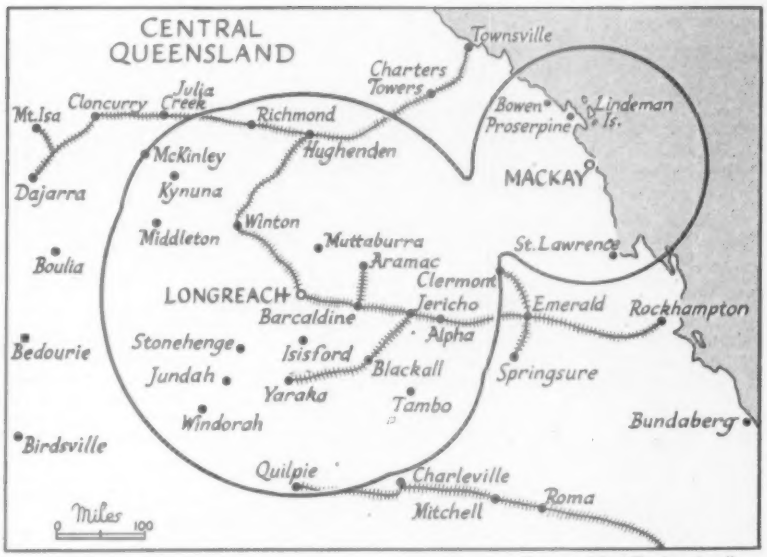


Fig. 7. Effect of lateral damping on stability (quadri-cycle undercarriage).

The Somerset Story

by Charles Kovacs



Map copyright "The Aeroplane."

Operating area covered by Somerset Airways' aircraft without refuelling.

LATE in 1950 two air-minded men, unaware of each other and some 12,000 miles apart, realized almost at the same time the great possibilities of light air-charter business in Australia. They recognized, for different reasons, that within the next 10 years or so the small charter aircraft could well become a familiar and indispensable adjunct to the life of Australia's vast outback.

One of these two men was Capt. Jesse Luxton, A.F.R.Ae.S., F.R.Met.S., M.S.L.A.E.A., a well-known British aviator with some 13,000 flying hours and an intimate knowledge of the World's skyways. Contemplating emigration to some new part of the Commonwealth (he had already spent 14 years in Africa), he was struck by a most unusual feature of Australian aviation. He was amazed to find out that while Australia's regular scheduled airlines were the most highly developed in the World per head of population, charter flying in that country was relatively non-existent.

Working on the basis of what happened in other countries, and considering Australia's extremely bad inland communications and the staggering distances of its wide open spaces, Capt. Luxton concluded that air-charter business must make fantastic strides in that country within the next 10 years.

The other man was an Australian, Mr. Gordon Lee. He lived in Muttaburra, a tiny township in the middle of Central-Western Queensland, one of the richest wool-growing areas; a vast, flat grazing country, of extreme heat and cold, devastating floods during the monsoon and dust-storms or bush fires during the droughts.

Mr. Lee was the proprietor of a road-transport concern at Muttaburra. During the "Wet" his vehicles were often bogged down for long periods.

He did not know much about aeroplanes but soon recognized the need for a light aircraft in his business, particularly during those critical periods when his crews needed quick relief. So he bought an Auster Aiglet and engaged a pilot, but hardly had time to see if this apparently extravagant investment would pay dividends; scores of his grazier customers rushed to him with requests for emergency services; food dropping and rescue work during floodtime, and the conveyance of ambulance cases, delivery of urgent mail parcels, medicine and spare parts.

He took out an air-charter licence, and as the result of experience drew exactly the same conclusion in Muttaburra as Capt. Luxton did in England—that air-charter business had a great future in the Australian outback and, in turn, a rapid development of the Australian outback would be greatly accelerated by the introduction of light aircraft on a commercial basis.

By chance he saw Capt. Luxton's advertisement in *Aircraft*, and he wasted no time in getting in touch with him. Luxton agreed to fly a light aircraft out from England to Queensland and to manage the air-charter business for him.

Leaving England in his Proctor Luxton completed an eventful solo flight, eventually crossing the Australian coast over Cape Talbot on March 3, 1952, and flying on to Longreach, the largest town in Central Queensland.

Somerset Airways, as the Lee concern was named, immediately moved its base from Muttaburra to the old Qantas hangar at Longreach, and the two men began operations with the two aircraft as the first organized air-charter firm in the west of Queensland. Afterwards Luxton and Lee formed a partnership.

From there on Somerset's story is one of sweeping success. The young firm's services were eagerly sought by graziers, stock and estate agents, local Government officials, sheep buyers, shearing contractors, ambulance brigades, doctors and dentists, the police—and even undertakers at times.

Somerset Airways quickly expanded, adding an extra aircraft to its fleet each year and at the same time standardizing all engines. Late in 1954 the firm opened approved workshops at Longreach for the overhaul, modification, repair, maintenance and servicing of all light aircraft, along with Auster spares and a distributing organization.

The great Thomson flood in 1955, the biggest flood for many years, gave a strong impetus to the young charter firm's development. The flood relief operation began at dawn on February 25 and was completed on March 31. Records show the performance of two of the aircraft, both Aiglets, which took part in this operation. During the five weeks they had flown 33,120 miles, supplied 115 homesteads with food, landed at 44 homesteads, made 127 other food drops, three medical-supply drops, and conveyed to hospital five ambulance cases. In 35 days they delivered 25 tons of food and 1¼ tons of mail. During the whole of the period the township of Muttaburra was supplied with fresh food and mail.

During the same year Somerset made a scintilometer survey on behalf of Mt. Isa Mines, Ltd., in search of uranium, totalling on this mission 300 flying hours. The larger part of this operation had to be done by hedge-hopping at 50 ft. until Mt. Isa Mines obtained a new scintilometer which made operations possible at 200 ft.

In January, 1957, the firm, operating five Austers from three bases—Longreach, Roma and Mackay—and approaching the 30,000-miles per month mark, was converted to a private

Left to right, Gordon F. Lee (chairman); W. G. Allen, Jr. (director); Capt. J. H. Luxton (managing director); Duncan S. McMaster (secretary), and Jack te Kloot (director).

A Cessna 182A and Austers of Somerset Airways at Longreach.

company with the original partners and a number of graziers and business men as shareholders. It became Somerset Airways Pty., Ltd. Lee was the first chairman and was appointed to the executive post of managing director (commercial), while Luxton became managing director (technical).

The business was registered as a public company on April 14, 1958. Lee gave up his executive post of managing director (commercial) due to other heavy business commitments, remaining as chairman. Luxton was appointed managing director, and Duncan S. McMaster (son of the late Sir Fergus McMaster, former chairman of Qantas) joined the company as secretary to take charge of commercial affairs.

Today the company has a fleet of six Austers and one Cessna 182A, has an import licence for a second Cessna and has made application to import two more. It employs one aeronautical engineer, seven pilots—all of them qualified aircraft mechanics—one apprentice aircraft mechanic, and an administrative staff of three. Somerset Airways, Pty., Ltd., now has the organization of a full-scale airline, and its four directors look forward to the future with confidence.

They have every reason to do so. When the partnership was established back in 1952 the two foundation members set a tentative target for increasing turnover at a rate of 50% each year on the first year's business. The anticipated figures have been beaten continuously during the past six years.

The name Somerset is as well known today in the Central West as the names of its early explorers Kennedy, Mitchell and Landsborough. And indeed Somerset has made no small contribution during its short existence to the development of this vast land by bringing modern amenities closer to isolated communities and by reducing the once-frustrating distances.

Somerset's aircraft sometimes carry doctors and oxygen cylinders and fly against time and weather to save a patient's life; they often carry fire fighters to save a homestead from the rage of bushfires, or postal technicians who pinpoint from the air broken telephone lines; they may fly serum to a stricken racehorse or take a sick stud ram to the nearest veterinary surgeon; they often carry sheep dogs and saddles for mustering, parts for tank sinker's broken-down plant, bookmakers to country racemeetings, and even corpses in canvas bags.

The impact of Somerset's operations on the grazing industry is clearly shown by the amazing increase in the number of privately owned airstrips during the past few years. When Somerset was established in 1950 there were 14 private landing strips within a radius of Longreach—today there are well over 150 strips in the same area. This shows that graziers are becoming air-minded as a result of Somerset's operations in the west. To encourage young graziers to fly their own light aircraft Somerset recently engaged an instructor for their new flying school.

At present the company has four private mail runs of about 250 miles each and intends to introduce a new one every two months.

The company is now developing a new method of picking up mail without landing. Flying trials for perfecting this new technique have begun. Successful development of this operation would mean a tremendous advance in speeding up mail collections from isolated properties.

One does not have to be an expert in aviation to see that future possibilities for air-charter work in Western Queensland are almost unlimited. In the first place this vast grazing land, although sparsely populated, boasts of the highest earning capacity per head of population in Australia—and in the World. In the second place, the cost of air transport compares favourably with other means of communication in this area. As an example a return trip between Longreach and Isisford, 148 miles by road, costs £14 when travelling by taxi or hire car—if the roads are dry. When the roads are wet, there is no way of getting there by surface transport. Somerset will do the same trip, the equivalent of 100 nautical miles for them, for £12. When one considers the difference in time, the cost of meals and accommodation saved on the trip, and the cleanliness of air travel as against travel by road or car on a dusty dirt road, it becomes obvious that the air-taxi is by far the better proposition.

Even in the case of longer trips, business executives and State departments are finding it cheaper to send their representatives on far western tours by air. The saving in time is tremendous. A 1½-hr. trip by air would take up to two days by road. Costs, too, are more than comparable, as the wear and tear on motor vehicles—and drivers—is terrific on these rough roads. Station agents, sheep buyers and stock inspectors are finding that it pays to travel by the outback air service. A buyer can fly to a sheep station, conclude his business, and be back in his office the same afternoon. The alternative would be several days' journey in a car over unmade roads.

Another important factor which augers well for the future of air-charter work in the outback is the degree of air safety compared with road safety. Latest statistics issued by the International Air Transport Association show that today it is three times safer to travel by air than by road on a passenger/mile basis. Somerset Airways has the proud record of having flown more than 12,000 hr. and more than one million miles with only one major accident.

Capt. Luxton puts this safety record down to the suitability of Auster Aiglets for bush work and is confident the company's new Cessnas are going to maintain the same standard. A bush pilot has to have a flying ability and general knowledge far above the average.

Early in 1958 the company introduced the first American aircraft, a Cessna 182A, to see if it would match the Auster in bush work. Since then the Cessna has proved itself worthy of its place in the Somerset fleet, but Luxton considers that the Cessna 180 with conventional undercarriage would be even more suitable for the company's operations. The Cessna has already equalled the Auster's performance from short primitive strips, and it has the added advantage of greater speed, range and flying comfort. The company has now decided to re-equip its fleet entirely with Cessnas.

Somerset aircraft and pilots' ability to land in all kinds of difficult conditions was recently demonstrated by a successful emergency landing in the heavily timbered mountains of the Dividing Range near Townsville. Jack Stewart, of Somerset Winton base, was flying at 7,000 ft. when he saw a piece of the propeller break away. He shut down the engine immediately as the whole wooden propeller disintegrated. Jack brought the aircraft down to an almost perfect textbook landing without any power available. He landed the aircraft on a narrow bush track and the only damage was a dent in the wing leading edge caused by striking a sapling on the side of the track.

Quite apart from the business man who finds the air-taxi almost indispensable these days, the advent of Somerset has also made life much easier for the ordinary working man. Many men working in the outback come from other States, and have homes and families often thousands of miles away. Should a man wish to return home urgently—in cases of illness or death—he can be delivered at the main airline terminal or railway within a few hours. Without Somerset the delay in reaching these points would probably make the journey impracticable. But even without taking into consideration these special cases of urgency when time is the most important factor, it is becoming more and more obvious that with its ever-increasing volume of business and its improving organization, Somerset's charter service is rapidly becoming the accepted means of communication for the average person in Central Western Queensland.

OPERATING STATISTICS

Year	Flying hours		Statute miles flown	Passengers carried	Medical flights
	hr.	min.			
1950 (three months) ..	115	31	7,971	—	—
1951	472	30	32,602	—	—
1952	470	50	35,812	—	—
1953	850	01	70,197	—	—
1954	1,585	04	118,344	—	17
1955	2,019	00	165,084	1,823	22
1956	2,632	18	216,941	2,682	27
1957	2,181	04	195,502	2,799	14
1958 (eight months) ..	1,965	21	190,653	2,788	16
Grand Total	12,291	39	1,023,106	10,092	96

Fifty Flight Assessments

by John Fricker

First of the 50 handling articles by the author was on the Hiller 360 helicopter in Paris.

EIGHT years ago, as a very green amateur pilot, I rather diffidently drifted into the job of writing flight test reports for THE AEROPLANE. Perhaps slightly less green now, but still very much an amateur, I find that the 50th of these assessments was recently published. This personal landmark therefore seems a convenient point to look back over a memorable period and discuss a few of the lessons learnt from handling, if only for a brief period, a number of very different types.

These cover aircraft* of American, British, Canadian, Czechoslovakian, Dutch, Egyptian, French, Indian, Italian, Russian and Swedish design or manufacture, and of both fixed- and rotating-wing design. The aeroplanes include piston-, turboprop- and jet-powered types, while the helicopters add ram- and pressure-jet propulsion, in addition to conventional reciprocating power.

Inevitably, if unfortunately, it is seldom possible to spend very much time in each new type, and unlike my contemporaries on *The Motor*, who usually test new vehicles over a period of about two weeks, most handling flights occupy less than an hour. It may be thought that any possible judgment would therefore be superficial, but this can be discounted (I hope) on two scores. First, and most important, is that these flights are not tests, in any sense of the word, but personal assessments or impressions. Secondly, in most cases, the extensive previous experience and performance figures established by highly skilled test pilots are made freely available to amplify one's observations.

Photographs copyright "The Aeroplane"

Helicopter training to solo standard was later generously donated by Westland Aircraft on the S-51.

Naturally, it is still preferable to make several short trips rather than one long one, in each new type, and in the case of light aircraft a week-end tour of the clubs would be ideal. Unfortunately, aircraft availability and weather, as well as the time factor, invariably prevent this happening. It is some consolation to observe, however, that when extensive use has been made of an aircraft subsequent to writing it up (as was the case with the Ercoupe, for example), the initial impressions in general have been entirely confirmed.

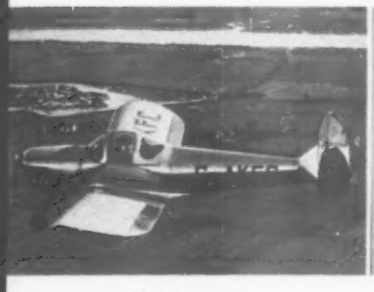
However brief a handling flight may be, to be included in this series every aspect of it must be personally undertaken from take-off to landing. In many cases, and particularly with military types owned by the Ministry of Supply, this is only possible if dual control is available. Where circumstances prevent the full range of handling from being completed, the articles are not included in this general series. This accounts for the absence of such types as the Hunter Trainer and the F-100F Super Sabre from the list, although the exhilarating transonic experiences which they provided have been reported in detail in THE AEROPLANE.

Ideally, of course, handling flights should be made solo, perhaps after a comprehensive dual check, and tribute must be paid here to several British companies who turn one loose on valuable prototypes with or without this formality. Miles Aircraft deserve particular mention in this respect, having entrusted the little Sparrowjet and the Student into my unaccompanied care, despite my very limited jet experience. Austers are also very good, and Westlands are another company to which we owe a particularly great debt, not only for allowing me to fly an S-51 solo for a couple of hours but also for providing the necessary dual instruction to make this possible.

This experience, although brief, provided the basic minimum background on helicopter handling which has enabled other types to be evaluated from the amateur pilot's point of view, but accumulating flying hours on rotorcraft is a very difficult process. The reason is not far to seek when it is considered that the 8½ hr. flying at Westlands was worth £1 per minute.

An introduction to helicopter handling had come some time before the Westland course, and in fact the first article in the series, in February, 1950, was on learning to fly the Hiller 360. At the invitation of Helicop-Air in Paris, I received a couple of hours' dual from Alan Bristow, in which a useful background of basic handling was obtained. Since then, other companies, including Bristols, Saunders-Roe and Air Service Training, as well as Westlands, have been kind enough to offer

* The full list comprises, in order of flight: Hiller 360; Dart Kitten; Cessna 170; Auster Aiglet Trainer; Aeronca Champion; Ercoupe; Auster B.4; Comper Swift; Piper Tri-Pacer; Fleet Canuck; D.H.C. Beaver 2; Lockheed T-33; Hunting Provost; Miles Sparrowjet; Westland S.51; Sud-Aviation Djinn; Fokker Mach Trainer; Bristol Sycamore; Piper Neptune-Cub; Agusta-Bell 47G; Auster Alpine; Auster AOP.9; Saab Safir; Hiller UH-12B; Cessna 180; Druine Turbulent; Zlin Z.226; Yak-18; Antonov An-2; Westland Widgeon; Auster Agricola; E.S.A.F. Gomhuriah; Edgar Percival EP.9; Beech Bonanza; Hunting Jet Provost; Saro Skeeter; Thruxton Jackaroo; Super Aero 45; Piper Apache; Hunting President; Aviation Traders Prentice; Fairey Gannet T.5; Hindustan HT-2; Piaggio P.136; Piper Super Cub; Miles Student; L.60 Brigadyr; G.B. Linnet; N.H.I. Kolibrie; Jodel D.117.



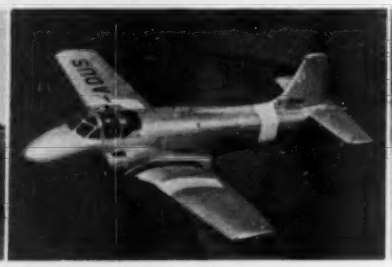
Ercoupe

Lockheed T-33A

Miles Sparrowjet

Turbulent

Antonov An-2



Hunting Jet Provost

Super Aero 45

Piper Apache

fairly extensive periods of dual and the opportunity of flying several widely differing types of helicopter.

Ten types of rotorcraft have so far been sampled, of which all but one have been described in this series. It seems to me, from a brief acquaintance with each, that helicopter types vary far more in their individual handling than do fixed-wing aircraft of equivalent weight. This can be attributed to many things; the relatively early stage of helicopter development, with consequent acceptance of inferior handling qualities; widely different designs of rotor heads and blades; and the varying application of power or manual controls.

It is slightly disconcerting to find that some small two/three-seat helicopters have control forces in certain circumstances that would be more appropriate to a four-engined bomber. Some companies resort to hydraulic servo assistance, even in very small helicopters, to solve this problem. Designers such as Raoul Hafner, however, have shown (in the Sycamore, for example) that such complication may be avoided while achieving light, pleasant and well co-ordinated controls. Most helicopters still have a long way to go in these respects, as with stability, and the potential for their refinement is virtually unlimited.

The author is briefed by Ranald Porteous, chief test pilot of Auster Aircraft, before flying the Agricola at Rearsby. This assessment also included dropping 7½ cwt. of fertilizer.

Photograph copyright "The Aeroplane"

Turning to fixed-wing types, on which I can speak with slightly more confidence, the main problem in writing about them seems to me interpretation. Elevator control force gradients and rolling criteria mean very little to the average pilot, and yet some figures must be quoted if absolute rather than relative assessments are to be obtained. It is of little use saying that the ailerons of a particular type are light or heavy unless one knows what is the assessor's criterion of normality, and this, of course, varies very widely.

One only has to compare the control sensitivities of British and American as against Continental light- and medium-weight aircraft to find that in general, the European types have rather lower stick forces and possibly more neutral stability. Of late, attention to light and responsive lateral control is improving in Britain, but to solve the problem of interpretation, we usually quote a representative rate of roll, in degrees per second, in cruising flight as well as a description in general terms.

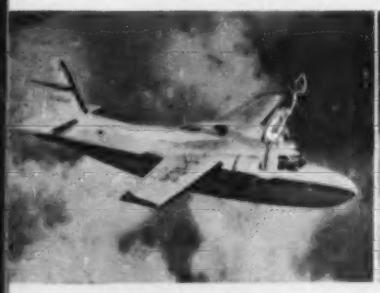
In a similar manner, the longitudinal stick force is usually quoted as the effort, in pounds, required to exert a 1*g* acceleration. Although this varies with speed, height and C.G. position, a representative range does give a useful indication, in absolute terms, of the elevator feel. As a guide to the uninitiated, rates of roll vary from the maximum human tolerance of about 350°/sec. in jet fighters with powered controls, to 20°/sec. or so, which might be found in a poor light aeroplane or in a good multi-engined transport. Anything in the region of 100°/sec. indicates, in my opinion, fairly powerful and effective lateral controls for most small- and medium-sized aircraft.

Longitudinal stick forces vary from about 3 lb. per *g* at high altitudes in jet fighters, which can then be overstressed or *g*-stalled with a one-handed tweak of the stick, to the 50 lb. per *g* needed to bring a B-47 out of a spiral dive. A more normal range is between 5 and 20 lb. per *g*, with 10 lb. as a reasonable figure for most light- and medium-weight aircraft.

When flying a new type, the aim is to cover such things as general handling, basic stability; climb and cruising performance; basic stalls from level flight, clean and in the approach configuration, power-off and power-on; trim changes; baulked landings, and, where possible, aerobatics (including spinning). The latter manœuvres occasion some amusement, largely because their infrequent occurrence makes a routine performance in a strange aeroplane unlikely. When *really* aerobatic types are encountered however, as in the case of the Zlin Trener, the Russian Yak-18 or even the Provost, with a 90-sec. inverted fuel and oil supply, the results are truly memorable.

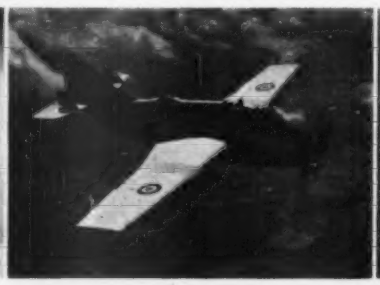
The Russian types flown were a source of particular pride in this series, since no other English-language journal has had a similar opportunity. In the case of the big Antonov biplane, a total of nearly 20 hours was accumulated in Moscow and Czechoslovakia when dropping parachutists, resulting in a thorough degree of familiarization. Although not included in this series, its predecessor, the veteran Po-2, or *Podeva*, was also flown, to the extent of nearly six hours' solo in Yugoslavia, in 1951.

One day, I hope to tell the story of the latter flights in full. In the meantime, I am hoping that the 100th flight assessment in THE AEROPLANE (in considerably less than a further eight years) will be on yet another Russian type.



Hunting President

ATL Prentice



Fairey Gannet T.5

Jodel D.117

Plenty to be Pleased About

GUESTS at the Handley Page Senior Staff Dinner in London on December 19 were not only provided with Christmas cheer but with glad tidings too. The guest of honour, SIR HUGH LUCAS-TOOTH, Bt., Conservative member for Hendon South, congratulated them that orders had been placed for the Victor 2 with the stand-off bomb and means of flight refuelling. Bearing in mind the fact that the prototype Victor 2 has not yet flown, this statement provided those present with the comforting reflection that the production lines were likely to be running for quite a while yet.

Though the numbers of V-bombers are microscopic in terms of war-time bombers, such as the Halifax of which 6,000 were turned out by the Group, the man-hours for V-bombers are such that production lines do not run rapidly out of work.

The second fact which gave a special fillip to the assembly was the news, triumphantly brought along by the Handley Page contingent from Reading headed by Mr. and Mrs. Manley Walker, was that the fourth Herald, and the second machine with Dart turbines, had made a successful first flight that very morning in the hands of Squadron Leader Hazelden.

SIR FREDERICK HANDLEY PAGE reminded those present that the date of the dinner had some significance. Fifty-five years earlier the Wright brothers had made their historic flight. In 1915, on the same date, the first big Handley Page bomber had flown.

On the subject of diversification, and the newly formed H.P. department which was looking into the application of aeronautical know-how to non-aeronautical applications, Sir Frederick had something to say about the possibilities of improving the economics of rail haulage in which the structure weight of carriages and wagons and wheels formed such a high proportion of the total. However, it was clear that he had so much faith in the future of civil aviation and the Dart Herald in particular that even the potential improvements which he envisaged would not enable the railways to compete with the economics of air transport. Consequently it was with tremendous enthusiasm that he was looking forward to the jubilee of Handley Page, Ltd., which is to be celebrated on June 17 next.

Advice from Leaders of Industry

WHERE save in a London club and in England would one be likely to find such a unique association as the Sopwith Apprentices dining together? This is not a large gathering. It scarcely could be, for those who paid a premium 40 years ago for the privilege of performing menial tasks in the Sopwith factory were few in numbers. That privilege must have been worth paying for: those apprentices have done well.

Once a year Sir Thomas Sopwith dines with the members of the club and this year two other famous Hawker Siddeley names, Sir Roy Dobson and Sir Frank Spriggs, were with him. All were concerned to advise the members of the association that they had a duty to the younger generation. The tradition had to be carried on and in some way, which members would have to find, the apprentices of this generation would have to have a chance of taking over from the original members of the club, who in the normal human way would steadily decrease in numbers.

Indeed, no reminder of this last sad fact was needed, for before the customary silent toast to the memory of the S.A.A.'s first president, Fred Sigrist, Mr. R. W. Sutton, chairman of the Association, had to add the name of Charlie Brothers, who had died since the previous dinner.

This year, in the absence of Capt. Duncan Davis, the toast of the president was proposed by MR. R. W. SUTTON, who delighted in rubbing home the fact that at its inception the Apprentices Association had been a rebel organization.

Replying, SIR THOMAS SOPWITH paid particular tribute to Mr. R. J. Ashfield and the fact that, as first designer, he produced designs which did not kill their pilots though in those faraway days stressing was not a widely practised art. He then insisted the necessity for keeping the club going by taking in the rising generation.

SIR FRANK SPRIGGS, who followed, strongly supported this proposition and added his own plea that the name of Sopwith should not be allowed to die.

AIR VICE-MARSHAL PANKHURST, who followed to reply for the Association, produced some figures from his indentures which were warmly received. Indeed, they are worth noting here as showing how much the early aeronautical enthusiasts were prepared to suffer in order to learn their art. Wages for Sopwith apprentices began at 4s. 6d. per week rising eventually in the fourth year to 10s. 6d. per week. From these vast sums, be it remembered, deductions were made for losses sustained by the firm. His observations made it clear also that, however hard a taskmaster Fred Sigrist had been, the lessons that he inculcated had borne good fruit.

AIR CDRE. C. B. WINCOTT followed with a tribute to the name of Hawker and in particular to the great pilot who had borne the name.

SIR ROY DOBSON naturally could not be too modest about the Avro organization and in particular about the 504 Apprentices. He too was concerned to emphasize how much was to be learned from these old principles of serving an apprenticeship.

MR. J. JEFFS, who as Commandant of London Airport has become so widely known on television, replied on the guests' behalf to the welcome very warmly extended by MR. J. H. WILLIAMS.

And we have a duty on behalf of all those fortunate to have been present to record their appreciation of the work of the untiring secretary, Mr. Victor Derrington, who, when we finally left, was still enthusiastically at work showing slides of all those lovely Sopwith aeroplanes without whose successes World aviation would have been the poorer.

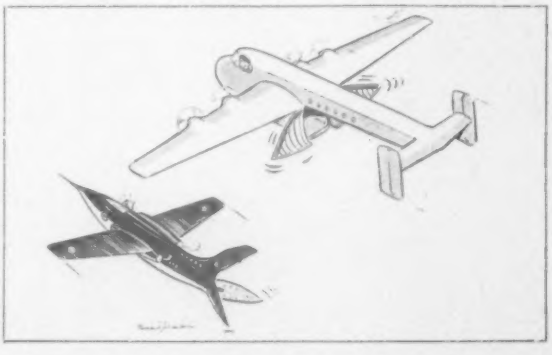
Dowty Expansion

AS we briefly recorded last week, an important step has been taken by the Dowty Group in their acquisition of Rotol, Ltd., and its subsidiary British Messier. This significant expansion of the Group's affairs formed the subject of a joint Bristol/Rolls-Royce/Dowty statement just before Christmas. By consolidating two of the largest organizations in our aircraft equipment industry it has brought about some measure of the rationalization that has come to be expected in the aircraft industry.

Certainly the move would seem to be a most logical one as both the Dowty and Rotol companies have for some while been occupied with somewhat similar lines of development. Moreover, they are geographically close together. The two organizations primarily concerned in the new arrangement believe that it will be to their mutual interest to effect a closer relationship and, that this can best be achieved under Dowty Group control.

While the undercarriage and associated hydraulic equipment business of British Messier has its parallel in Dowty's own well-known specialist concern with landing-gear work, the incorporation of aircraft propeller design and manufacture in the Group's activity is particularly interesting as a new field of interest for Dowty. As our regular readers are aware Rotol propellers have been chosen as standard equipment for a number of important civil and military aircraft—for example, they are used on nearly all the Vickers Viscounts in civil operation throughout the World. Likewise, British Messier undercarriages are widely used—they are on the English Electric Lightning, the Gnat, the Britannia, and the SC.1.

The history of Rotol, Ltd., goes back to 1937 when the company was formed as a joint enterprise by Rolls-Royce, Ltd., and the Bristol Aeroplane Company. Messier Aircraft Equipment, Ltd., came into being in 1938 and from this sprang British Messier, formed in 1947, which became a subsidiary of the Rotol company in 1952.



News of Aircraft, Engines and Missiles

SOON TO FLY.—An impression of the Sud-Aviation S.E. 3200 28-seat helicopter, which is intended for both civil and military use. It has three Turboméca Turmo III shaft-turbines.

PROTEUS PROGRESS.—Latest version of the Bristol Proteus is the 770 Series turboprop. It has a take-off e.h.p. of 4,615 (4,130 s.h.p. and 1,260-lb. thrust). Cruise s.f.c. is 0.484 lb./e.h.p./hr. (0.501 for the Proteus 765 and 0.511 for the Proteus 755) at 25,000 ft. and 300 knots in I.S.A. conditions and at maximum continuous power. Bristol Britannias now coming off the production line have the Proteus 760 and most long-range Britannias are now so powered. The Proteus 705 in B.O.A.C. Britannia 102s has now been granted an overhaul period of 2,000 hr. by the A.R.B.

FRENCH 10-SEATER.—Initial flight tests of the Dassault M.D.415 10-seat transport aircraft which is now being assembled will begin in March. Its two Turboméca Bastan turboprops should give it a cruising speed of more than 340 m.p.h. and in military form it can be used as a trainer. A variety of underwing stores can be carried.

STARFIGHTER CLIMB.—Seven new rate-of-climb records were established, subject to confirmation, by a Lockheed F-104 Starfighter at Mugu, Calif., recently. The most significant are the climb to 25,000 m. in 4 min. 26.3 sec., and to 20,000 m. in 3 min. 42.99 sec., for which no existing records stand.

ACHIEVEMENT.—A full conversion from vertical to forward flight was made by the Bell XV-3 on December 18; it is the first tilting-rotor fixed-wing aircraft to do so.

PEAKED PROBOSCIS. — All-weather capability is conferred on the Russian MiG-17 single-seat fighter by the installation of radar in the central bullet and extended upper portion of the intake. This new photograph, the first of this variant to be published in the West, shows that the cannon armament is retained, and a recording camera is fitted alongside the nose.

BASTAN POWERED.—The second S.E.116 (two 805-h.p. Turboméca Bastan turboprops), the development aircraft for the S.E.117 Voltigeur, made a 45-min. first flight on December 15. Two Wright Cyclone piston engines powered the first S.E.116.

PIONEER DISCOVERIES.—Pioneer III, the recent Moon-probe rocket which travelled some 67,000 miles into space, showed that there are two intense radiation bands around the Earth instead of one as previously believed. The inner band has a peak intensity between 1,400 and 3,400 miles up, while the outer band is strongest between 8,000 and 12,000 miles. Pioneer III also indicated that the Earth's magnetic field extends only 36,000 miles into space.

MEXICAN MAKER.—A company has been formed in Mexico to undertake the manufacture of aircraft. Known as Lockheed-Azcarate S.A., it is jointly owned by Lockheed Aircraft Corpn., and Mexican interests. First project, according to *Aviation Daily*, will be a light utility aircraft, for which Lockheed's Georgia Division will provide design prototypes and tooling.

APPROACH AID.—The Australian-developed precision visual guide path approach aid is being tested in the U.S., Fiji and Australia. It is also to be tested in Canada for possible application at airfields in the far north of the country. Designed by Dr. J. C. Lane, Director of Aviation Medicine in the Department of Civil Aviation, and Mr. R. Cumming, of the Commonwealth Aeronautical Laboratories, the aid is a precise arrangement of staggered rows of lights which present a single bar of light when a correct approach is made.

AUTOMATIC LANDING.—A Boeing B-47 has recently been landed by automatic control at the manufacturers' Marietta plant during the current evaluation trials of the automatic-landing system developed by the Bell Aircraft Corpn. Employing an automatic radar tracking beam, the system was briefly described in THE AEROPLANE of July 25, 1958, p. 132.

SNARK ORDER.—The U.S.A.F. has placed a contract worth $50 million for the production of Snark intercontinental SSMs.

BOLD ORION. — The U.S.A.F. is developing an air-launched ballistic missile with a range of 1,000 to 1,500 miles. This new ASM, the Bold Orion, is reported to have been test-launched at 60,000 ft. from a B-58 Hustler bomber flying at 1,100 m.p.h.

JT-4 TESTING.—On December 20 a Pratt & Whitney JT-4 (J75) turbojet completed a year of flight testing, mounted in the port inner pod of the Boeing 707 prototype. A total of 325 hr. has been flown with the 15,000-lb. two-spool engine at heights up to 42,000 ft. and speeds up to M=0.95.

REGULUS CANCELLED.—Production of the Chance Vought Regulus 2 air-breathing SSM has been cancelled by the U.S. Navy. This decision has been made as a defence economy and will save $100 million.

NEW U.S. AIRCRAFT.—Now flying is the Longren Centaur high-wing utility aeroplane powered by a 300-b.h.p. Lycoming R-680 radial engine. The Centaur has folding wings of 40 ft. 5½ in. span and is 31 ft. 9 in. long. It can carry 1,800 lb. of cargo, cruising at 100 m.p.h.

JAP HELICOPTERS.—The first two Mitsubishi-built Sikorsky S-55 helicopters were completed at Nagoya on December 16. About 40 are to be made in the first batch.

SWEDISH EXPORT.—The Finnish Air Force recently took delivery of the first of 20 Saab-91D Safir trainers (180-h.p. Lycoming O-360-A1A). Eighteen similar aircraft have been ordered by Holland; 10 91Cs are to go to Ethiopia.

ROCKETDYNE BOOSTER. — The NASA has chosen the Rocketdyne division of North American Aviation to design and develop a liquid-propellent rocket motor with a thrust of one to one and a half million pounds. This motor will give the U.S. the ability to send very large loads into space; its development will take about four years.

MIRAGE DEVELOPMENTS. — A SEPR 841 booster rocket unit has now been fitted to the Dassault Mirage IIIA to supplement its Atar 9 turbojet. Weighing only 190 lb., the liquid-propellent rocket develops a maximum thrust of 3,703 lb. at heights above 52,000 ft. Dassault is now building the Mirage IIIB tandem two-seat trainer.

PROJECT MERCURY.—Mr. T. Keith Glennan, administrator of the NASA, revealed on December 17 that the NASA man-in-space programme was known as Project Mercury. He said that success in this venture was, at the very earliest "several years away."

WITHOUT FUSS.—A plaque commemorating the crossing of the Atlantic by the airship R.34 in 1919 was unveiled at Roosevelt Field, New York, on December 15. It is in bronze, set on a marble plinth, and was donated by the Air League of the British Empire.

Il-18 PRODUCTION.—It is reported from Berlin that the turboprop Ilyushin Il-18 is to be produced in East Germany.

Commercial Aviation Affairs

B.O.A.C. LOSS.—On December 24, shortly before midday, a B.O.A.C. Britannia 312 crashed at Winkton, near Christchurch, Hampshire. The aircraft was on a test flight from London Airport after a Check 4 overhaul and nine of the flight and engineering crew of 12, including Capt. J. E. Jackson, who was in command, lost their lives. Discussion of the cause of the accident must await the result of the investigations, but it is known that the crew had asked Hurn (which was closed by fog) for permission to descend and had been referred to London F.I.R.

1958 TRAFFIC.—Provisional figures issued by ICAO show an increase of only 5% in passenger-miles performed by the World's scheduled airlines in 1958, compared with annual increases of 13% or more for the previous ten years. The number of passengers flown increased by 4%.

STRIKE SITUATION. — Over the week-end of December 13-14, Eastern Airlines settled its differences with striking I.A.M. mechanics, but remained strike-bound by the action of members of the flight engineers' union. At midnight on December 20, A.L.P.A. declared a strike against American Airlines, involving about 1,500 pilots, on the issues of salaries and the "third man" in the jet cockpit. American Airlines' attempts to have the strike declared illegal failed. Both Eastern and American are members of the six-airline "mutual assistance" pact, under which Capital Airlines—the first to suffer in the current round of strikes—has already received payments from the other five.

CARAVELLE PLANS.—Air France will use the Caravelle initially on its service from Paris to Istanbul via Rome and Athens, starting on May 15. Subsequently, the type will go on the service Paris-Warsaw-Moscow in July, Paris-Rome-Tel Aviv in September, Paris-Algiers in October, Paris-Stockholm about December and Nice-London in 1960.

SKYWAYS COACH AIR.—Administration and organization of all Skyways' Coach Air services will in future be handled by a newly formed subsidiary known as Skyways Coach Air, Ltd. Directors are Mr. Eric Rylands (managing) and Mr. Charles F. Dickson, O.B.E., and the operational and booking office is at 33 Elizabeth Street, London, S.W.1. (Phone, Sloane 0646.) For administrative reasons the Coach Air services to Vichy and Montpellier remain under the control of Skyways, Ltd.

IATA IN PARIS.—Traffic Conferences of IATA will continue their recessed Cannes meeting in Paris next week. The most important issue still to be decided concerns the use of differential fares for turbojet services. A compromise solution is likely to be reached at this meeting.

NO-PASSPORT TRIPS.—Starting with Air Charter's Southend-Calais run, no-passport day trips to France by air will be possible early this year. From Easter the facility will also apply to Silver City's Lydd-Le Touquet service.

U.S. TRAFFIC DECLINE.—After three months of improving traffic results, the U.S. domestic trunk operators suffered another set-back in November, when traffic declined by 0.7% compared with November, 1957. Available seat-miles had been reduced from 3,240 million to 2,900 million, so the average load factor improved from 55.28% to 61.38%.

AFRICARGO EXPANSION.—Douglas DC-6Cs have now replaced Yorks on the Hunting-Clan Africargo service which operates twice-weekly from London Airport to Frankfurt, Malta, Benghazi, Khartoum, Aden, Entebbe, Nairobi, Salisbury and Johannesburg. The DC-6Cs provide 5,000 cu. ft. capacity in the fuselage and over 500 cu. ft. in two underfloor holds. Weather radar is fitted, a flight attendant is carried and bunks are provided for a spare crew, to permit 24-hour operations.

U.A.T. ACCIDENT.—On December 26, a Union Aéromaritime de Transport DC-6B crashed after take-off from Salisbury, Southern Rhodesia, on a flight to Brazzaville and Paris. Of the 63 passengers and seven crew on board, three passengers lost their lives.

CAPT. MACMASTER.—We regret to record the death, on December 28, of Capt. Donald Farquhar MacMaster, who was Qantas' flight superintendent and, later, asst. operations manager.

INFORMATION INTERCHANGE.—British European Airways acted as hosts to representatives of Air France, Alitalia, B.O.A.C., K.L.M., Lufthansa, Qantas, S.A.A., Sabena, S.A.S., Swissair, T.A.I. and U.A.T. at the eighth Jet Overhaul Conference held from December 15 to 18. Here is a picture taken at the conference at the Washington Hotel, London.

News About People

R.A.F. PROMOTIONS.—Among the R.A.F. half-yearly promotions which took effect on January 1, 1959, are four from Air Commodore to Air Vice-Marshal. These are A.V.M. D. J. P. Lee, A.V.M. J. G. Davis, A.V.M. B. K. Burnett and A.V.M. G. Silyn-Roberts.

MR. H. G. NELSON.—The English Electric Co., Ltd., announces that Mr. H. G. Nelson, M.Inst.C.E., M.I.Mech.E., M.I.E.E., managing director of the company, has also been appointed deputy chairman of the following subsidiary companies: D. Napier and Son, Ltd., Marconi's Wireless Telegraph Co., Ltd., Marconi Instruments, Ltd., the English Electric Valve Co., Ltd., Vulcan Foundry, Ltd., and Robert Stephenson and Hawthorns, Ltd., and of the associated company, the Marconi International Marine Communication Co., Ltd.

ICAO'S SECRETARY GENERAL.—Following the retirement next summer of Mr. Carl Ljungberg after seven years' service, Mr. Ronald M. Macdonnell, Deputy Under-Secretary of the Canadian Department of External Affairs, will be secretary general of ICAO for a term of five years. He will join the Organization after the 12th session of the assembly at San Diego next June.

A.R.B. POST.—The Air Registration Board announces the appointment of Mr. A. A. Rubbra, B.Sc., F.R.Ae.S., M.I.Mech.E., technical director of Rolls-Royce, Ltd., to the Board in the vacancy caused by the retirement of Mr. A. G. Elliott. Mr. Rubbra is a member of the council of the Aircraft Research Association and of the Automobile Division of the Institution of Mechanical Engineers; he serves on the council, technical board and technical executive committee of the S.B.A.C.

FIGHTER COMMAND.—Air Cdre. A. Foord-Kelcey, C.B.E., A.F.C., is to become A.O.C., No. 11 Group, Fighter Command, with the acting rank of Air Vice-Marshal, on January 12. Attending the 1958 course at the Imperial Defence College, Air Cdre. Foord-Kelcey was previously Assistant Chief of Staff, Allied Air Forces Central Europe.

Military Aviation Affairs

RUSSIAN ROCKETS.—According to the U.S. Government-subsidized Rand Corpn. of scientists, the Soviet Union will have 300 operational ICBMs within the next 18 months, and at least 50% will be able to land within three miles of their targets. This is said to open the possibility of eliminating the main Western deterrent—Strategic Air Command—in one blow.

MYSTERES v. MiGs.—Israeli Air Force Mystère IVAs intercepted a formation of Egyptian MiG-17s when they crossed the border into the Negev on December 20. In the ensuing engagement at 32,000 ft. one of the MiGs was hit by cannon fire and its pilot baled out over Egyptian territory.

U.S.A.F. REDUCTIONS.—The U.S.A.F. is reported to have reduced its planned purchases of Convair B-58 Hustlers from 47 aircraft to approximately 36. The cost of each B-58 is understood to be nearly $8 million. The first B-58 crash was on December 16 and the pilot, Maj. Richard Smith, was killed when his parachute failed to open after ejection at 650 m.p.h., 32,000 feet over Texas. Subsequently all Hustlers were grounded. In the fiscal year starting next July the U.S.A.F. is also expected to buy fewer fighter types than the six now under procurement—F-100 Super Sabre, F-101 Voodoo, F-102 Delta Dagger, F-104 Starfighter, F-105 Thunderchief and F-106 Delta Dart.

INDIAN DELIVERY.—A batch of five Fairey Firefly 4s modified for target-towing is being delivered from Ringway to the Indian Navy by Airwork. This is the second batch of TT Fireflies for the Indian Navy, five Mk. 1s having been delivered in 1954-55.

KOREAN MATADORS.—The United Nations Command in Seoul has announced that Martin Matador tactical missiles, with nuclear capability, have been introduced into South Korea. This follows the build-up of Communist military strength in North Korea, despite the Armistice agreement prohibiting such an increase on either side. In view of the North Korean violation, the U.N. now intends to restore the balance of military power.

U.S. NAVY COMPETITION.—The McDonnell F4H-1 two-seater (two G.E. J79s) has won the U.S. Navy competition for an all-weather jet interceptor; the loser is the Chance Vought F8U-3 Crusader single-seater (Pratt & Whitney J75). The fact that the former carries both pilot and radar operator, and that it has two engines, were deciding factors. Initial contracts were for 23 aircraft from McDonnell and 18 from Vought. Three F8U-3s were delivered; the rest of the contract is cancelled. The F4H-1, scheduled to be in service in the "early 1960s," will carry Sparrow and Sidewinder missiles.

NATO CHOICE.—As we reported last week a Breguet design is the winner of the recent NATO competition for a standardized anti-submarine aircraft. The British designs submitted were prejudiced by the fact that as two Rolls-Royce Tynes were the powerplants specified for the competing types, the airframe was almost bound to be selected from a Continental company. This was the case in the first NATO competition, for a lightweight fighter, which was based on the Bristol Orpheus turbojet. A. V. Roe have been linked with Breguet for the production of a selected design, although the British company submitted its own proposal to NATO for a Tyne-engined aircraft.

HERCULES ARRIVAL.—One of the 12 Lockheed C-130 Hercules military transport aircraft ordered for the Royal Australian Air Force is seen here flying over Sydney Harbour. The first five arrived at Richmond on December 13; the rest are expected before the end of this month.

Correspondence

From Air Chief Marshal Sir Arthur Murray Longmore, G.C.B., D.S.O., R.A.F.(Retd.).

The First Deck Take-off

MAY I be permitted to correct a slight error in the article "Naval Aviation's Background" in your issue of November 28, 1958. It was Commander Samson who flew the Short off the forecastle of the "Hibernia" in Weymouth Bay in May, 1912, *not* R. Gregory. I happened to be there at the time flying a Deperdussin monoplane escorting the Royal Yacht. We used a small field close to the east end of the Weymouth Beach.

Wentworth, Surrey. ARTHUR M. LONGMORE.

[We are grateful to Sir Arthur Longmore for this historical note. C. G. Grey in his book "Sea Flyers" gives the credit to Lieut. Gregory—as do some others—for the first aeroplane take-off from a ship under way. THE AEROPLANE of May 16, 1912, however, carried a photograph of Cdr. Samson taking off from H.M.S. "Hibernia" which appears to have been moving at the time.—ED.]

Polar Pioneers

READING the article on the above subject in your issue of December 12, I felt it would be a pity if the somewhat scanty reference to Sir Douglas Mawson's interest in aircraft in the Antarctic were allowed to pass without a further note on the subject.

This does seem to have been one of the early cases of a pioneer's efforts to utilize aviation, when one realizes that the REP monoplane* referred to was manufactured by Vickers in 1911 and was, I believe, fitted with a three-cylinder Anzani engine. The aeroplane was taken out to Australia, prior to the arrival of the Expedition's ship called "Aurora," and Lieutenant Watkins went with it as pilot.

The object of the exercise was to create interest and collect funds for the Antarctic Expedition, but, unfortunately, in one of the early flights, at Adelaide, the machine crashed. Despite this, the wings were left behind and the fuselage and engine taken in a large crate to Adelieland, where F. H. (Bill) Bickerton was in charge of it. After storing it in an ice cave for nearly a year, he used it to tow sledges. When the wheels had been discarded and large runners fitted, with a man sitting on each one to operate the somewhat primitive brakes which they rigged up, the machine towed four sledges and the three men at the fabulous speed of six miles per hour.

However, after two or three days' use, the engine finally blew up and, as Bill Bickerton remarks in his report in the book on the Expedition entitled "The Home of the Blizzard," published by Heinemann, "We were very sorry to turn our backs on the air sledge."

Piccadilly, W.1. J. H. DAVIS.

*No doubt under licence from Robert Esnault-Pelterie.

From Major-General H. J. Parham.

Rotor Disc Loadings

I RECENTLY watched a crop-spraying demonstration by a Kolibrie ram-jet helicopter of European Helicopters, Ltd. I was impressed not only by the remarkable accuracy and lack of "time-wasting" of the flying but particularly by the way in which the two edges of each swath of the spray were defined. There seemed to be less random spread than one had seen before.

This prompts me to ask a question from your technical readers, namely this: how is disc-loading related to velocity of downwash?

I see from your excellent VTOL Number of December 12 that disc-loadings vary from over 6 lb. to (in the Kolibrie) 1.84 lb. per sq. ft. This means that since the Kolibrie is "treading the air" more delicately than the others its downwash is of lower velocity. After hitting the ground it should therefore spread laterally to a lesser distance than would happen with a higher disc-loading.

If one adds to this the very wide spray bars, extending far outside the rotor radius, one may have the reason for the Kolibrie's apparent ability to imitate the gardener walking slowly alongside a bed with watering can in outstretched arm spraying only what he *wants* to spray.

I was lucky enough to have a few minutes flying as a passenger and, to one who learned to fly on moving wings a quarter of a century ago, it was a bit of an experience to take-off from, and land onto, a small trailer hitched to a Land Rover. The controllability and superb outlook made this safe and easy—so it seemed.

The Kolibrie strikes one as a rugged, simple job whose brightly painted structure emphasizes its close kinship with the ordinary farm implements of today.

Ipswich. H. J. PARHAM.

Load-meters

STATIC aeroplane load-meters, which emit a howl, long, loud and lustily, whenever the designer's A.U.W. is exceeded, sealed against fiddling fingers, frequently rechecked and calibrated and their use enforced by law, are just 55 years overdue—this year.

Some inspired inventor should now get moving to be in business on this essential pre-flight gadget. The insurance people should back him, in their own interests, as well as that of the public, pilots, passengers and parcels.

Let a tail-end query be posed. How much is a standing, wet aeroplane (fully loaded) heavier than a dry one (fully loaded), and who takes the last guess before it flies?—or attempts to do so?

Gloucester. L. MORGAN.

Roundabout

The Years That Fly. 1958 has gone, another year is among us and aviation, the love of my life, shows that, unlike its natural medium, it is compressible. But Old Wren's Almanac notes the brighter portents. This column recently attended two highly resurgent functions, one at Lyneham where Transport Command's business is so brisk that they have just opened a new and bigger Officers Mess, accommodating 150 and costing about £600,000 to build. The occasion was probably 1958's biggest R.A.F. social scrum—a thousand people, headed by the C.-in-C., A.M. Sir Andrew "Square" McKee, attended a Mess Ball where the good R.A.F. spirit was manifest. Oysters and scampi, too.

*

VIP Blip. The other occasion was the inaugural dinner of the new and important Signals Command, when the C.A.S. recalled that during a recent GCA practice, his instructor told the controller, "Do you know you have the C.A.S. up here and at your mercy?" The controller replied, "Well to me he's just another blip on the screen." "So tonight," said the C.A.S., continuing his speech, "I speak as Duty Blip."

*

With Warmest Regards. Let's talk about Christmas cards, especially the one that an engine company put out some years ago. It had a red cover with a white silhouette of one of their engines embossed in the middle. One of the cards was sent back from an aircraft company which used the engine, with the scribbled comment: "Congratulations on your appropriate card featuring a white-hot engine on a red-hot background."

*

"Sorry to leave this wonderful party so soon—must go—my wife's whim—and she has a whim of iron."

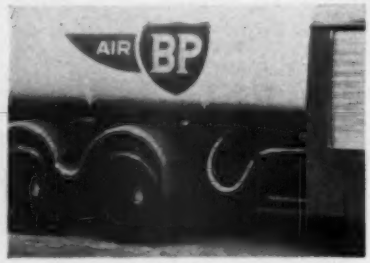
by Lorenz

NOTES AND EVENTS

NUCLEAR SYMPOSIUM.—In collaboration with the British Nuclear Energy Conference, the Institute of Physics is holding a symposium on "Nuclear Fuel Cycles" in the lecture theatre of the Institution of Civil Engineers on January 22-23. Application forms for attendance and details of the programme can be obtained from the secretary of the Institute, 47 Belgrave Square, London, S.W.1.

SHOW EQUIPMENT.—Among the exhibits to be shown by Ketay, Ltd., of Romford, at the Physical Society Exhibition (January 19-22) is a pressure ratio computer. This unit has been developed for measuring and indicating the angle of incidence of high-speed aircraft.

FURNACE ALLIANCE. — The General Electric Co., Ltd., and Vacuum Industrial Applications, Ltd., of Wishaw, Scotland, are to develop jointly vacuum-heating techniques and design and manufacture complete vacuum furnace installations.



NEW INSIGNIA.—As from January 1 the B.P. Aviation Service is known as Air B.P. The double-winged symbol formerly carried by all fuelling vehicles of this international aviation fuelling service is now replaced by the green-and-yellow B.P. shield flanked by a single red wing on a white background.

RADIO COMPASS.—The Marconi AD712 ADF equipment fitted with a crystal-controlled tuning system is to go into a number of transport aircraft. Currently flying as dual installations in B.O.A.C. D.H. Comet 4s, the AD712 is to be fitted in Hunting-Clan's two Bristol Britannias and three Vickers Viscount 833s. It is also being installed in the Vickers Vanguard, the Armstrong Whitworth Argosy, and the Boeing 707s for B.O.A.C.

MAINTENANCE STAND.—A new type of hydraulically operated aircraft maintenance stand which is to be used by the Fleet Air Arm for servicing Scimitars. The stand, which has a load capacity of ½-ton, was developed and constructed by the Unistrut Division of Sankey-Sheldon, Ltd., one of the Guest, Keen and Nettlefold group of companies.

ROYAL VISIT. — On December 9 H.R.H. Princess Margaret visited the works of Rist's Wires and Cables, Ltd., at Newcastle-under-Lyme. The mayor of Newcastle, Mr. W. E. Welsby, presented Mr. D. A. V. Rist, managing director, to Her Royal Highness, who saw the various aspects of cable manufacture during her tour of the factory.

NEW PLANT.—A new heat-treatment plant has been installed in the steel foundry of Edgar Allen and Co., Ltd., of Sheffield. The new plant will treat austenitic (12-14%) manganese and other alloy-steel castings.

PLESSEY RECTIFIERS.—Following their licensing agreement with the General Instruments Corpn., the Plessey Co., Ltd., is to produce a new range of Simet silicon rectifiers. They will be hermetically sealed medium-power rectifiers for operation in ambient temperatures between −55° C. and +150° C. and suitable for a wide range of applications.

NICKEL-BASE ALLOYS. — In a review of the nickel industry for 1958, Dr. J. F. Thompson, chairman of the International Nickel Co. of Canada, Ltd., estimated that a typical new commercial jet transport employs approximately 2½ tons of nickel in various alloys, including 1½ tons in the construction of its powerplants. Inconel X nickel-chromium alloy was used for the fabricated sheet metal skin of the North American X-15 and nickel alloys are also being employed for honeycomb structure of various high-speed air vehicles.

Birth Notices

Baker.—On Dec. 6, at R.A.F. Hospital, Akrotiri, Cyprus, to Ann (*née* Thomas), wife of Sqn. Ldr. Baker—a daughter.

Ball.—On Dec. 12, at Zachary Merton Maternity Hospital, Sussex, to Jane (*née* Thomas), wife of Flt. Lt. Derek Ball—a son.

Claridge.—On Dec. 4, to Jill (*née* Titley), wife of Flt. Lt. G. J. B. Claridge, of Bury, Hunts—a daughter.

Collins.—On Dec. 16, at R.A.F. Hospital, Wroughton, to Veronica (*née* Ellis), wife of Sqn. Ldr. M. G. Collins—a daughter.

Hobson.—On Dec. 11, at Stamford and Rutland General Hospital, Lincs, to Anne (*née* Page), wife of Sqn. Ldr. J. F. Hobson—a son.

McCulloch.—On Dec. 13, at R.A.F. Hospital, Ely, to Patricia, wife of Sqn. Ldr. T. A. McCulloch—a son.

Scanlon.—On Dec. 13, at R.A.F. Hospital, Ely, to Dorothy (*née* Oxborough), wife of Sqn. Ldr. S. T. Scanlon—a son.

Stillwell.—On Dec. 9, to Muriel, wife of Flt. Lt. J. S. Stillwell—a son.

Aviation Calendar

January 3.—British Interplanetary Society lecture "Rocket Combustion Research with Liquid Propellent Engines," by D. S. Carton (College of Aeronautics), at Caxton Hall, Caxton Street, **London,** S.W.1, at 18.00 hrs.

January 5.—R.Ae.S. Derby Branch, A.G.M. and 10-min. papers, at the Rolls-Royce Welfare Hall, Nightingale Rd., **Derby,** at 18.15 hrs.

January 6.—R.Ae.S. Young People's Lecture, "Rocket Flight in Space," by Dr. L. R. Shepherd, at the Royal Society of Arts, 6 John Adam Street, **London,** W.C.2, at 15.00 hrs.

January 6.—R.Ae.S. Luton Branch lecture, "Flight-testing of Modern Prototype Aircraft," by C. F. Bethwaite (A. V. Roe), in the Napier senior staff canteen, **Luton Airport,** at 18.15 hrs.

January 6. — R.Ae.S. London Airport Branch, film show, at B.E.A.'s Viking Centre Cinema, Hatton Cross, **London Airport,** at 18.00 hrs.

January 7.—R.Ae.S. Brough Branch lecture, "The Tyne Turbo-propeller Engine," by D. McClean (assistant chief designer, Rolls-Royce), in the lecture hall, Electricity Offices, Ferensway, **Hull,** at 19.30 hrs.

January 7.—R.Ae.S. Southampton Branch lecture, "Modern Aircraft Maintenance Procedure and Techniques," by A. G. Nunn (senior planning engineer, B.O.A.C.) in the Institute of Education, University of **Southampton,** at 20.00 hrs.

January 7.—R.Ae.S. Reading Branch lecture, "Interplanetary Flight," by J. E. Simpson, in the Palmer Hall, West Street, **Reading,** at 19.30 hrs.

January 7.—R.Ae.S. Bristol Branch, Brains Trust, at Filton House, **Bristol,** at 18.00 hrs.

January 7.—R.Ae.S. Weybridge Branch, Brains Trust, at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge,** at 18.10 hrs.

January 8.—R.Ae.S. Main Lecture, "Safe Mechanisms," by R. Hafner (chief designer, helicopters, Bristol Aircraft, Ltd.), at the Institution of Mechanical Engineers, Birdcage Walk, **London,** S.W.1, at 18.00 hrs.

January 8. — R.Ae.S. Gloucester and Cheltenham Branch lecture, "Guidance and Control," by L. H. Bedford, at St. Mary's College, St. George's Place, **Cheltenham,** at 19.30 hrs.

January 8.—R.Ae.S. Isle of Wight Branch lecture, "The Work of an Air Correspondent," by Angus Macpherson, at the Saunders-Roe Sports and Social Club, Church Path, **East Cowes,** at 18.00 hrs.

January 8.—R.Ae.S. Swindon Branch, A.G.M. and lecture, "Test Flying," by L. R. Colquhoun (Supermarine) at the College, Victoria Road, **Swindon,** at 19.00 hrs.

January 12.—R.Ae.S. Henlow Branch lecture, "Vertical Take-off and Landing," by D. Keith-Lucas (chief designer, Short Bros.), in Building 62, R.A.F. Technical College, **Henlow,** at 19.30 hrs.

January 13.—R.Ae.S. lecture, "Stress Corrosion—The Engineer's View," by P. H. Wall, in the library, 4 Hamilton Place, **London,** W.1, at 19.00 hrs.

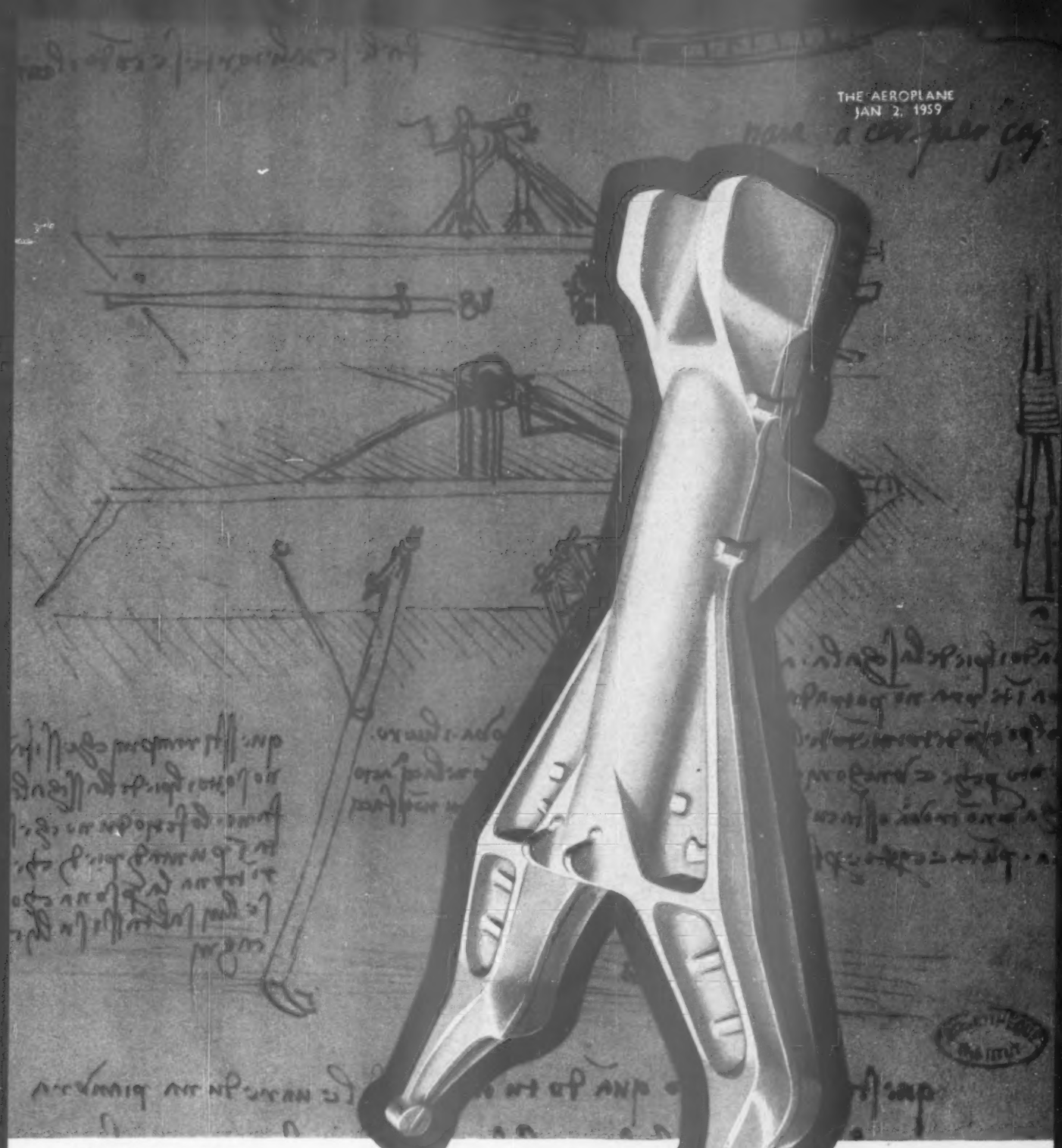
January 13.—R.Ae.S. Boscombe Down Branch lecture, "Experiences on the Trans-Antarctic Expedition," by Sqn. Ldr. J. H. Lewis, in the lecture hall, A. and A.E.E., **Boscombe Down,** at 17.45 hrs.

Company Notices

NEW COMPANIES

J. P. Aero-Com Engineering Co., Ltd. (616,812)—Private co. Reg. Dec. 15. Cap. £100 in £1 shs. Subscribers (each with one share): Jean Herbert, company director, and Thomas A. Herbert, company director, both of 156 Strand, London, W.C.2. First directors to be appointed by subscribers. Sec.: T. A. Herbert.

Lockheed Precision Products, Ltd. (616,402)—Private co. Reg. Dec. 9. Cap. £100,000 in £1 shs. Objects: To carry on the business of manufacturers of and dealers in automobiles, motors, tractors, aircraft aeronautical devices and engines of all kinds, and components and accessories therefor, etc. Subscribers (each with one sh.): R. H. V. Dixon, solicitor, and A. G. Staplehurst, solicitor's clerk, both of 4 Throgmorton Avenue, London, E.C.2. First directors, Edward B. Boughton, Willie Emmott, Denis T. Brock and Austin C. Burdon. Sols.: Travers Smith Braithwaite and Co., London, E.C.2. Reg. off.: Tachbrook Rd., Leamington Spa, Warwicks.



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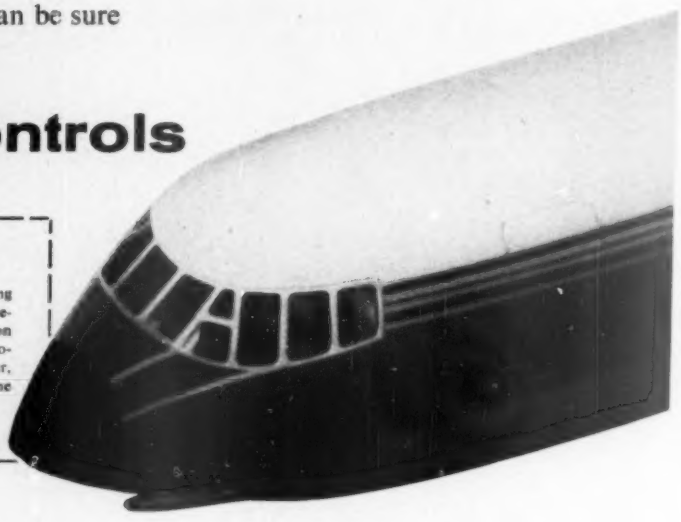

* See page 11 for answer.

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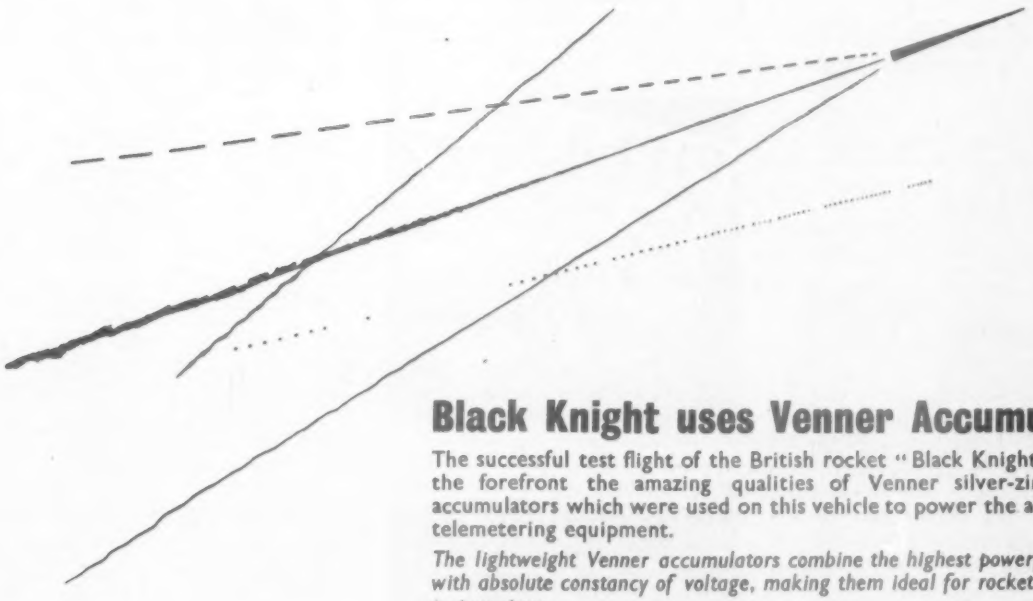

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APPLICATION NO. 2392 between London and Nicosia at an initial frequency of one return flight weekly increasing later to three return flights weekly.

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APPLICATION NO. 2396 between Exeter and Dinard.

APPLICATION NO. 2397 between Southampton and Dinard.

(b) At a frequency of three return flights weekly from June to September each year and two return flights weekly from October to May each year, increasing later according to traffic demand:—

APPLICATION NO. 2398 between Exeter and Paris.

APPLICATION NO. 2399 between Exeter and Dublin.

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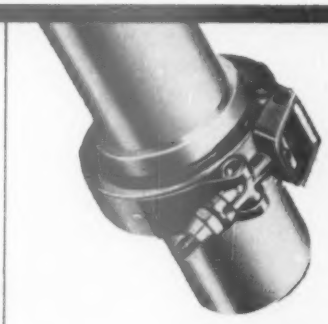

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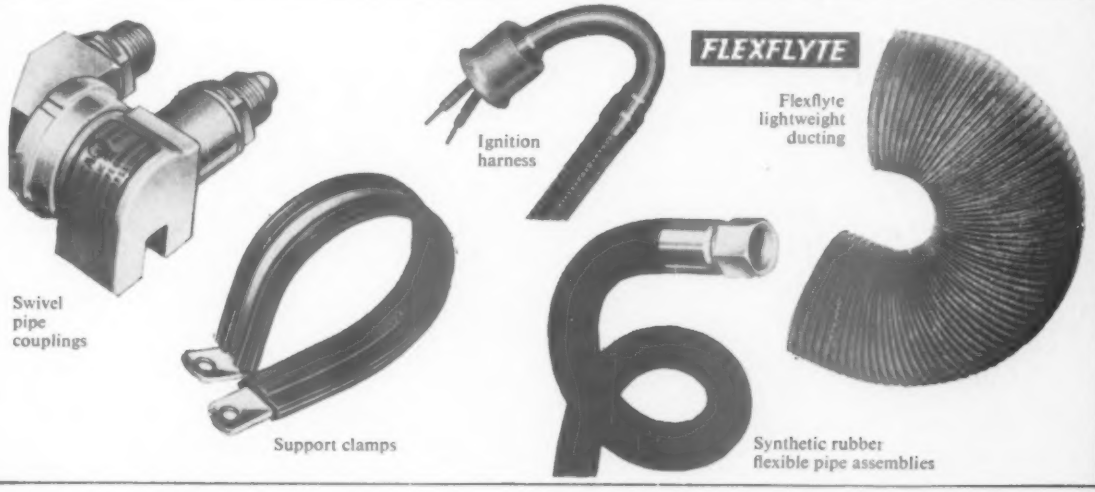

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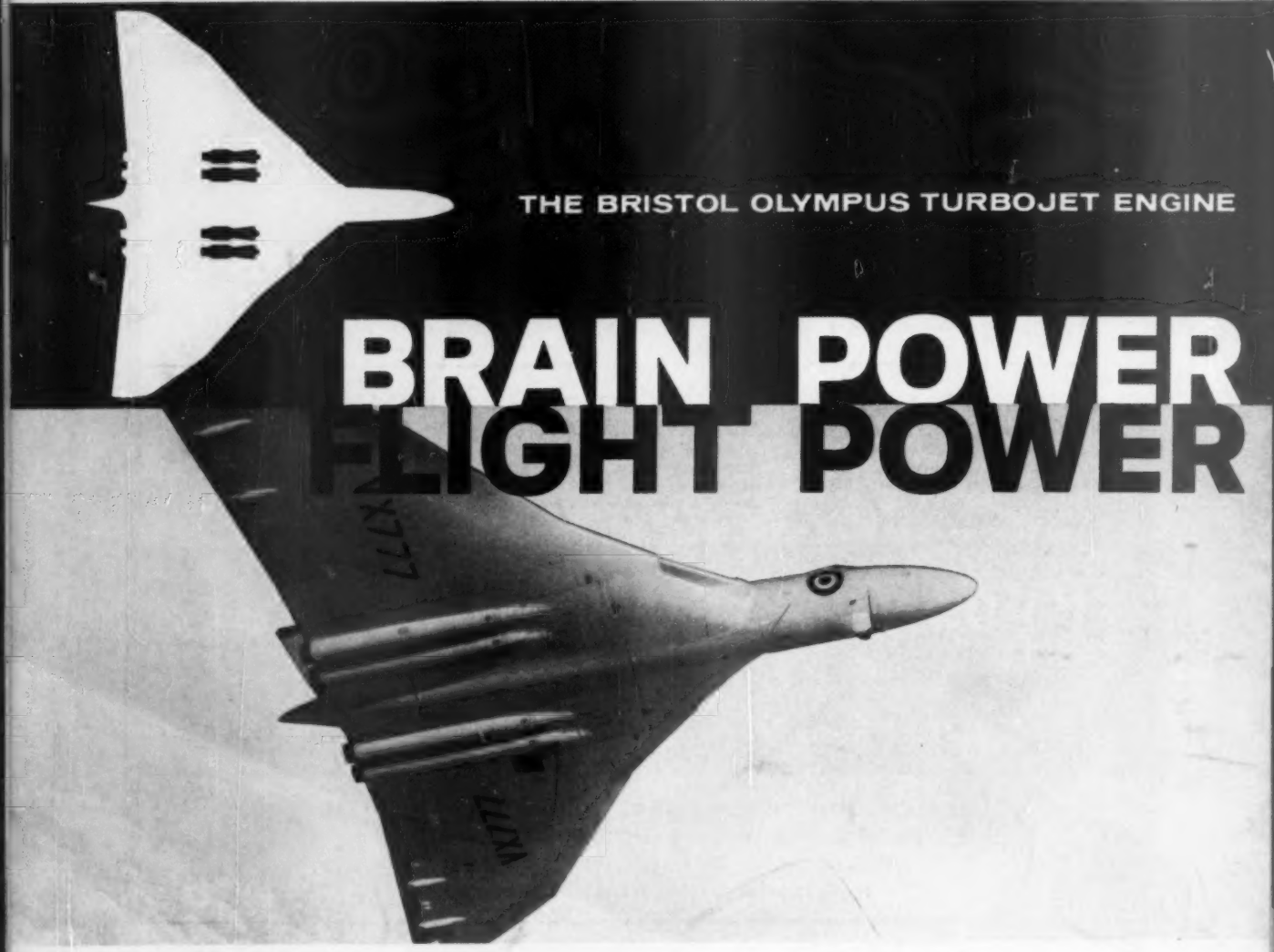

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